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MODERN METALS

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The aluminum industry is too large and basic to operate on a non-profit basis.

Sheet customers may order lighter gauges to avoid increase; building sheet should be eliminated.

Building sheet price was a grave mistake . . . the purpose for which it was introduced failed to materialize.

Extrusion price increases cannot solve more serious problem of extended credit terms.

U. S. Steel offers can stock 33% cheaper; could halt inroads from aluminum.

The small profits producers enjoy on their heavy shipments of pig to Europe must be spent there to avoid domestic income tax.

What's needed is get the industry back to living by published price list.

FOIL PRICE HIKES SMALL, BUT HELPFUL; WILL NOT STOP FLOOD OF CUT-RATE IMPORTS.

STEEL CONDUIT PRICES REDUCED; ALUMINUM PRICES CUT 5% TO MATCH.

INCREASE IN SEMI-FAB PRICES TOO SMALL, INCONSISTENT; WILL HAVE LITTLE AFFECT.

FABRICATORS COMMENTS

URGENT PROBLEM : ALUMINUM PRICING & OUTSIDE COMPETITION

What the industry needs is less talk of expansion and long-term markets; an industry leader to restore order.

(SEE PAGE)

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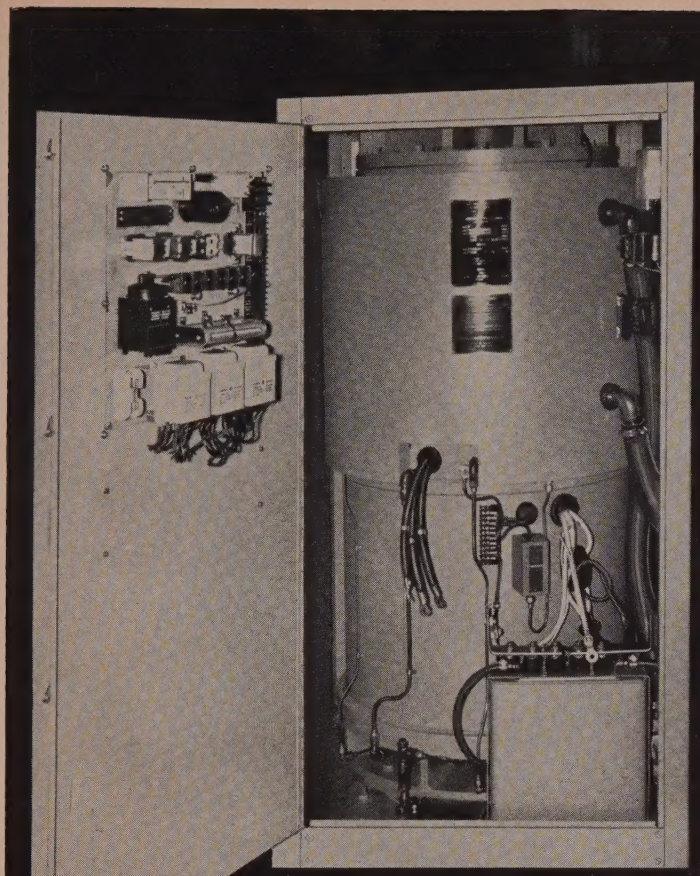

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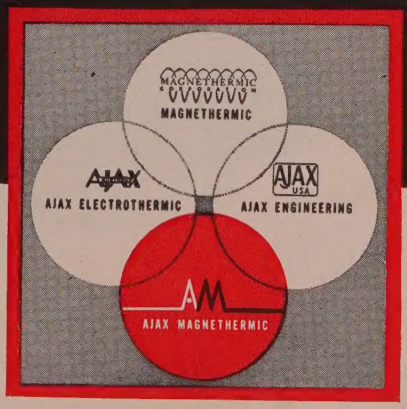

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MODERN METALS
Read in companies that produce, fabricate and cast aluminum, magnesium and titanium, and firms that use these metals in manufacturing end products.

ON THE COVER: Recent aluminum mill product price increases gave rise to the possibility that a trend to an overall firming of industry price schedules was in the offing. In an effort to find out if such a trend was a reality or purely fantasy Modern Metals surveyed independent fabricators. The article starting on page 34 details fabricator opinions on the price hikes, what they think the future is in aluminum pricing, and other facets of the problem. The article also includes some of the more interesting comments which accompanied answers to our questionnaire and a table listing some typical aluminum prices.

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Modern Metals

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NEW REFRACTORY MAY REDUCE ALUMINUM PRODUCTION COSTS 40
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THREADLESS FITTINGS IN RACK, RAILING INSTALLATIONS 86
Cincinnati contractor saw need for faster pipe rack assembly; idea for cast fittings solved problem, created new pipe uses.

4

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Letters

Prices Are Complex

Sirs:

This pricing system for aluminum has become most complex. . . Why don't the producers and fabricators get together—at least sufficiently to stabilize the cost of major products like sheet? We have different salesmen calling almost every day, and none of them appears to have the same price book.

It's confusing when one just wants to buy aluminum at a fair price. . .

"P"—Iowa

MM—Suh, the law says that no industry group can get together and fix prices. As we view it, nobody could accuse the aluminum industry of price fixing because everybody has his own "special deal" going.

Starting on page 34 of this issue, we've tried to show the picture, including what some major fabricators and users think of marketplace prices for aluminum. But we haven't any suggestions as to how the problem can be solved, nor when it will be.

If history records 1960 as significant, it can well go down as the first postwar year that the ultimate consumer regained absolute control over the seller. In the process, he may well have stopped inflation (which no government can do) and started dictating what he will pay for what he wants.

Much of the so-called boom of the past 15 years has been artificial. Maybe the years ahead will become known as the "sane sixties" rather than the "sizzling sixties." If so, the phonies will suffer. But aluminum, like other materials, will find its price level—and everyone will benefit.

Low Pressure Casting

Sirs:

In the July issue of MODERN METALS your article, "How Chevrolet Casts Aluminum for Corvair Engines," discusses the process of low pressure permanent mold casting. We are interested in this process, and we wonder if you could direct us to someone familiar with this technique.

Any information you can give us on anyone able to do low pressure permanent mold casting would be greatly appreciated.

"G"—Massachusetts

MM—There may be modifications of this process in use in the U.S.A., but we don't know of any specific foundry that is using it. (If any reader knows of such an operation, we'll appreciate hearing from him.)

The process used at the Chevrolet foundry in Massena is, as we understand it, controlled by Alumasc, Ltd., Northhamptonshire, England, but is licensed to Chevrolet by Karl Schmidt of Germany.

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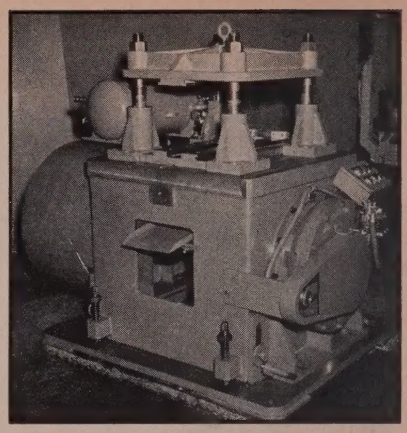
As a result, we can never remember when our subscriptions expire. Of all these we receive, the one we would most hate to have lapse is modern Metals. Please



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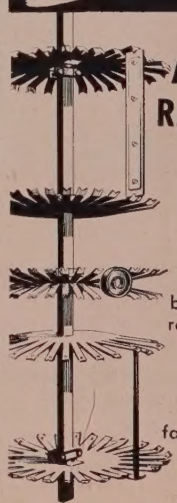

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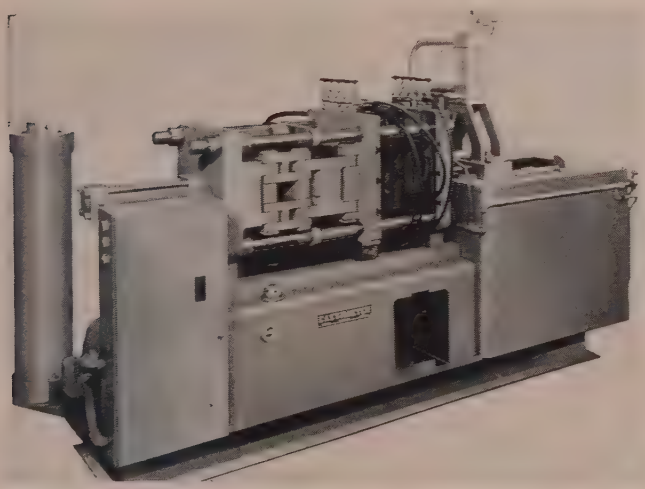
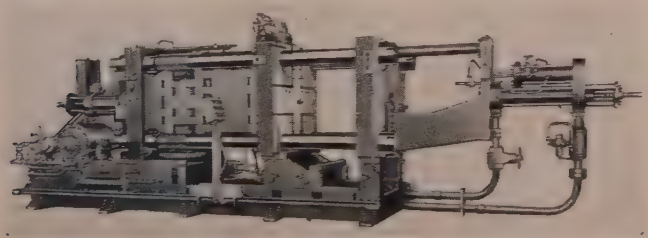


MODEL 7Z 100-ton hot chamber automatic for high speed production of small castings.



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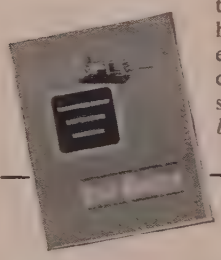

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Just keep the magazine rolling. You're doing the light metals field a great service. One complaint: You should be a weekly or a bi-monthly magazine. . .

"R"—Arizona

MM—One thing we do exceedingly well around here is remind subscribers when it's time to renew. Fortunately for us, about 78% decide they want more of our propaganda and renew year after year.

Despite the fact that most industrial and trade books have gone into the "numbers game," are literally shooting for circulation figures by the tens of thousands, and are offering their books free, we still believe that responsible, progressive, executives want to pay for the magazines which interest them most.

Fortunately, each year we acquire more subscribers like Mr. R. and 1960 is already our biggest year for circulation.

As for coming out weekly, we are barely able to meet the monthly deadline. One of our troubles is that we're foolhardy enough to go around digging up newsworthy developments. We ignore most of the five to ten pounds of news releases the mailman lugs up to our attic every day. But so much is happening in light metals every day that we spend too much time trying to figure out what subjects should get immediate attention—such as "the aluminum pricing problem" (on page 34).

On Welding Aluminum

Sirs:

. . . If you plan to reprint the current series on welding aluminum put me down for three copies. . . .

"P"—New Jersey

MM—This feature will probably run to ten installments—perhaps 50 pages in all. So it will be a big reprint.

To date, we've received about 100 reprint requests. If we get orders for 1000, it will justify the expense (at about $1.00 a copy).

Alodized Windows for New Zealand

Sirs:

I have just been perusing Modern Metals and am very interested in the Alodine finish for aluminum windows. I note that you publish a booklet describing the uses of Alodine, etc., for the protective treatment of aluminum, and would appreciate a copy of this.

We . . . go as far as the etching stage in finalizing our work, but have considered anodizing too expensive both from the purchase of plant and its uses points of view. . . .

"J"—New Zealand

MM—While we don't publish a booklet on Alodine, we've sent your letter to Amchem Products of Ambler, Pa. They'll be happy to send you full details.

This letter is interesting because it points up a fact not generally known. It has only been in the last few years that aluminum windows were introduced "down under," and we understand, despite relatively cheap lumber, use of them doubles each year. Doors and siding, we hear, are starting to catch on.

It is our hope that the aluminum window, door, siding and roofing businesses abroad will escape the suicidal price-cutting rat-race that presently exists in the U. S. Our advice to those readers abroad: if you see a price war developing, form a cartel and exclude the bad operators. Better still, shoot them. If you don't they'll wreck your industry just as they're murdering it here.

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Complete range of stretching capacities from 150 to 750 tons, for levelling ferrous and non-ferrous sheets in sizes up to 120" wide x 500" long.

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That's how the new Super Satellite rotary diazo printer lets draftsmen and engineers eliminate the expense and delay of sending out for prints. Manufactured by Grico, Inc., of Cuyahoga Falls, Ohio, it's the fastest machine of its type in the low priced field.

The feedboard (A) and paper guide (B) are made of aluminum, extruded, polished and anodized by General Extrusions, Inc. They not only add beauty and usefulness to the white-printer's cabinet, but they also help the manufacturer hold down his production costs.

This is another example of how General Extrusions is constantly helping out in the production of new, modern developments in all sorts of fields. Perhaps you have a problem that G.E.I. engineers could help you solve. The answer could be as near as your telephone.

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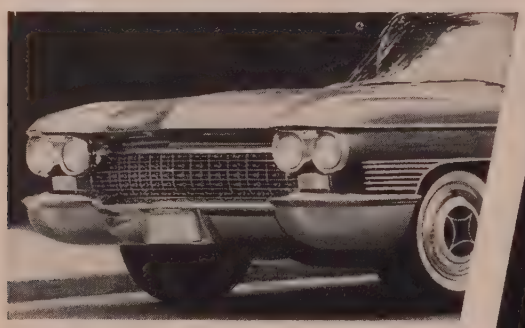

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CHEMICAL POLISH FOR ALUMINUM

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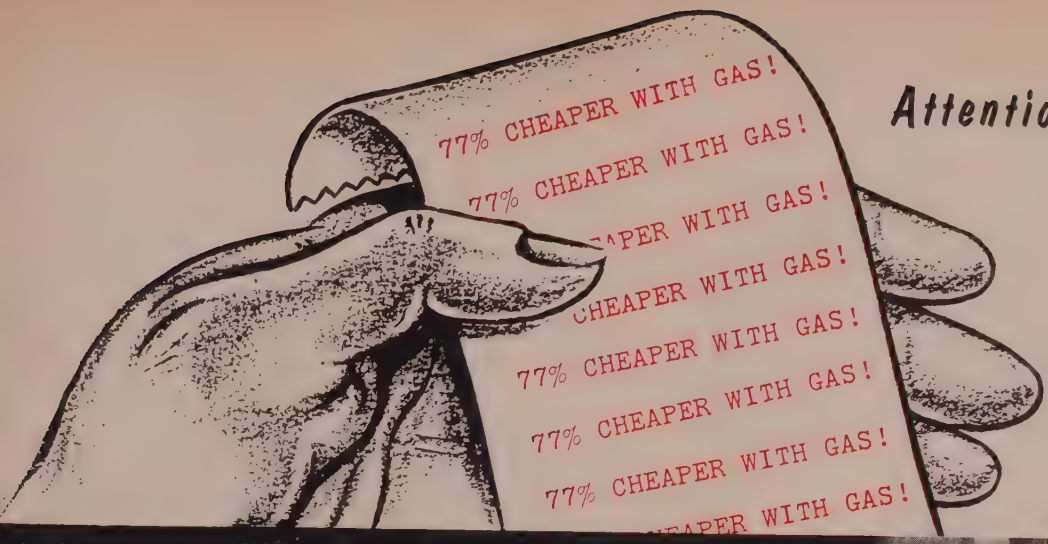
Here and There

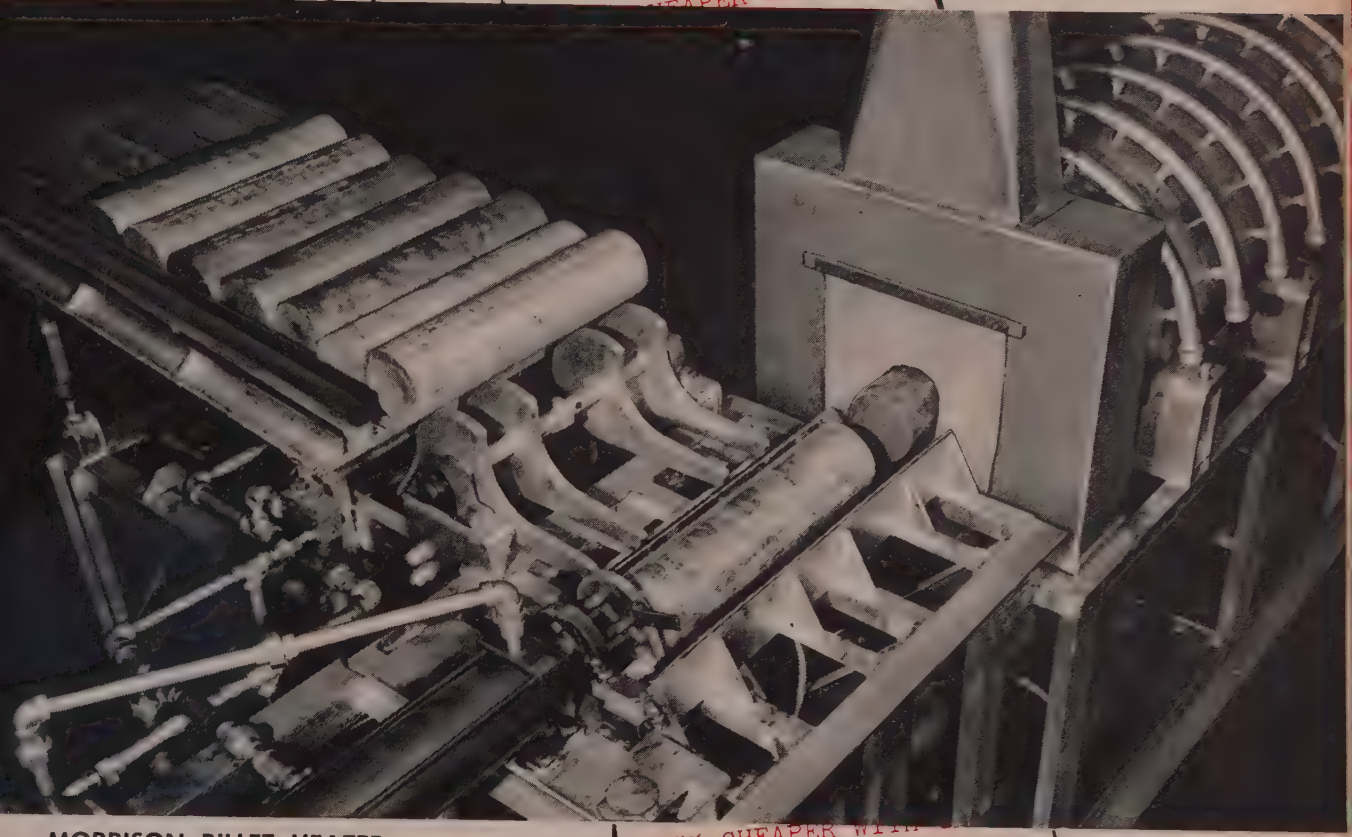
Aluminum and Echo-2 » » Echo No. 2, the U. S.'s spectacular new space traveler, is a balloon-like sphere as large as a 10-story building. The amazing thing about it, though, is its material, a clear DuPont polyester film called "Mylar" to which aluminum has been applied under high vacuum by a secret process. To the casual eye, this material looks very much like fairly thin aluminum foil. The marriage of Mylar and aluminum was performed by the National Metallizing Division of Standard Packaging Corp. An interesting feature of this giant balloon is the fact that it contains small radio beacons — wafer-thin discs imbedded in the material. There is one on each side of the balloon for balance. These have been tested and work in such a way that while the metallized balloon is in space there will be direct telemetry. Echo No. 2 is the first of a series of passive communications satellites to bounce radio and television signals. This is accomplished by that thin (7 millionths of an inch) coating of aluminum which gives the balloon its high degree of radio wave reflectiveness. The space vehicle, furled at launching in a 28-inch space package weighing 30 pounds, was fabricated by the G. T. Schjeldahl Co., Northfield, Minn. It inflated itself gradually at 1000 miles above earth by residual air and by gas from 30 pounds of sublimating powders carried inside.

New Heat-Treatable Ti Alloys » » From Imperial Chemical Industries Ltd., Europe's most important producer of titanium, comes word that they are developing heat-treatable alloys which, upon heat treating, have a high surface hardness while having a ductile core. Binary alloys containing 0.6 to 1.2% beryllium and having a hardness of 228 to 241 Vhn before heat treatment show a case hardness on the order of 500 Vhn after heat treatment, while the core hardness drops to less than 200. Yield strength is in the 100,000 psi range, and elongation 5 to 11%. Test heats of ternary and quaternary alloys containing 0.25 to 2% molybdenum and/or silicon have yielded even greater surface hardness and depth of penetration. Surface hardness is maintained at temperatures up to 700°F.

U.K.'s Biggest Aluminum Market » » Building and construction field is aluminum's prime outlet in the U.S. But in the United Kingdom transportation is the biggest single outlet for the light metal, consuming about 280 tons a day. British railroaders, car builders, etc. have long been aware of aluminum's worth in many types of railroad rolling stock. A recent symposium on the subject sponsored by the Aluminium Development Association and Britain's Institution of Locomotive Engineers revealed the depth of interest in the metal for this broad application. While the Rolls Royce and Bentley cars seem to offer the outstanding examples of cast aluminum engine blocks, indications are that this application is bound to grow,



Attention: Extruders!



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Actual case histories prove it — Morrison gas-fired billet heaters are saving aluminum extruders as much as 77% in heating costs as compared with electric heaters. You too can economize with Morrison, and at the same time realize the benefits of heating uniformity, simplicity of operation, and low upkeep costs built into every Morrison heater. Prove it to yourself — send for a documented case history.

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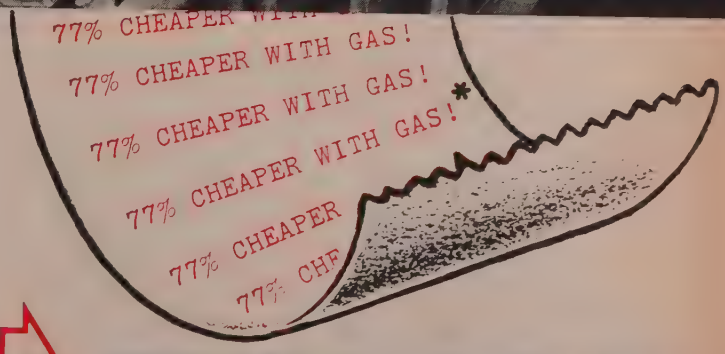

*** SEND FOR "CASE HISTORY"**

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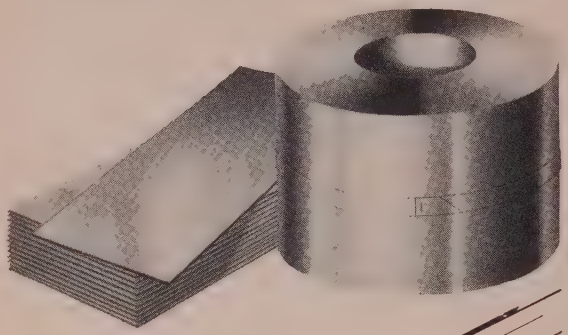

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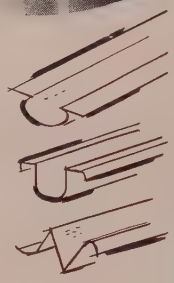

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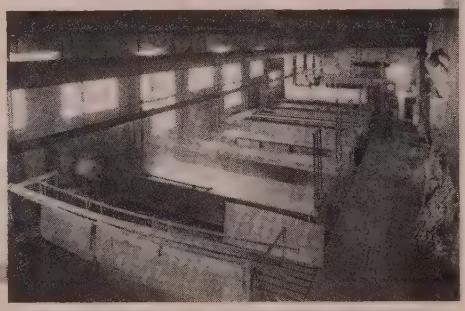

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though a "hot metal" deal in the British auto field would seem impractical. The shipbuilding industry seems to be more favorably disposed toward aluminum for passenger vessel superstructures.

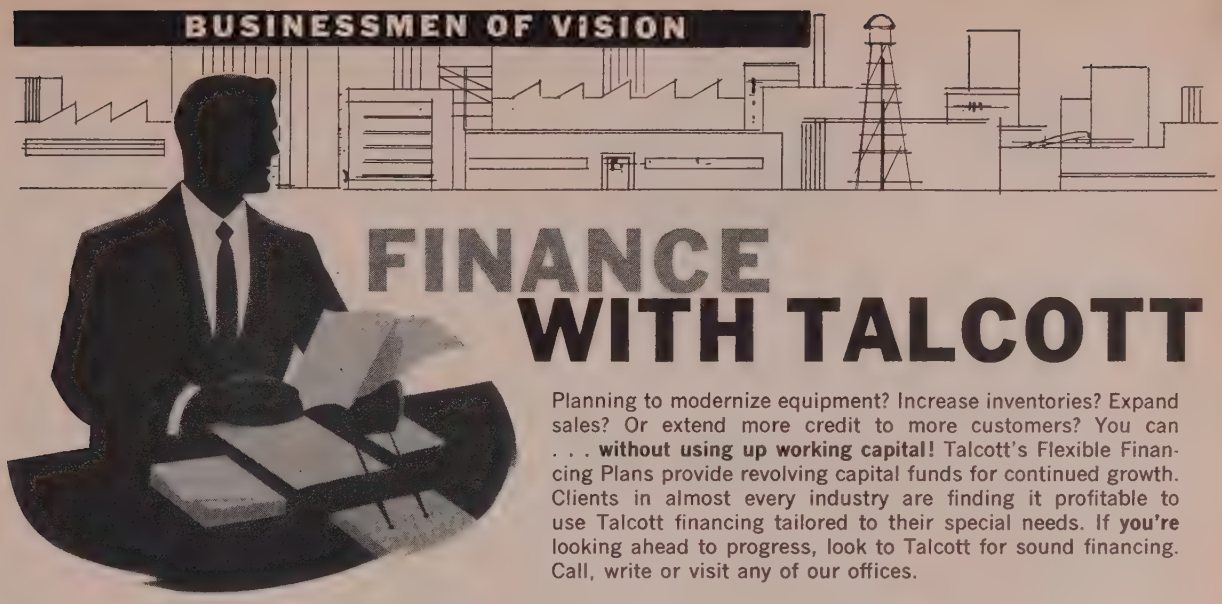
Adhesive Bonds Trailer Roofs » » Five years ago the truck trailer industry would have had misgivings about this new manufacturing technique used by Fruehauf Trailer: The company eschews welding for adhesives in the production of roofs for Fruehauf Volume Vans. It's easier and faster for lighter weight van building. Aluminum Z-channel crossbows are given applications of a polysulfide cement which is based on a Thiokol Chemical Co. liquid polymer. The channels are put in a long jig and the aluminum sheet is placed over them. The aluminum is stretched and heat is used to cure the adhesive. The roof panel is then fastened to the side walls of the van body by stitching.

West Germans Pinched » » On the international scene, nearly all signs point to continuing growth in aluminum consumption. West Germany, for example, should chew up 400,000 tons of aluminum (including secondary) this year — a hefty 19% gain over the amount used last year. But German fabricators are said to be growing uneasy about their dependence upon foreign metal; about a third of the 228,000 tons of primary metal consumed in the country last year was imported. Canada provided about 45% of the imported metal; the U. S. about 40%. So there's talk of boosting West German production of primary. Vereinigte Aluminium-Werke, the country's biggest producer, plans to boost capacity from the present 125,000 tons annually to 165,000 tons by 1963.

Russia apparently » » needs all the aluminum it can make. Shipments of Soviet aluminum to the United Kingdom were at a 4000-ton annual rate for the first six months of '60 — and most of it was shipped in to fulfill contracts made a year or more ago. Last year the Russians shipped 15,600 tons of aluminum to the U. K. We hear talk that plans are underway to boost Soviet Bloc output 150% by 1965 (compared with 1959), but details are scarce.

Another Try at Curtainwalls » » Canadair Ltd., one of the biggest aircraft builders north of the border, is taking a shot at the curtainwall business in a drive to diversify. One of its first jobs will be to supply all the metal detail of the aluminum and glass skin of Montreal's new 34-story CIL Building, the largest and tallest welded structure in the UK. Canadair has formed a new architectural products department within its Missiles and Systems Division to make and test curtainwalls. The company won the contract because of its experience with aluminum, to say nothing of its knowledge of aerodynamics and thermodynamics. The aircraft outfit will make more than 4000 insulated, black porcelain enameled aluminum panels, 4 feet high by 4½ inches wide, plus 52,700 linear feet of aluminum extrusions which will become the building's mullions. Announcement of Canadair's move into the architectural field reminded us of North American

BUSINESSMEN OF VISION



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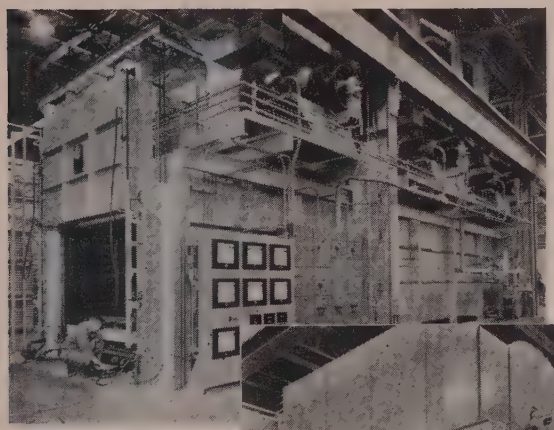

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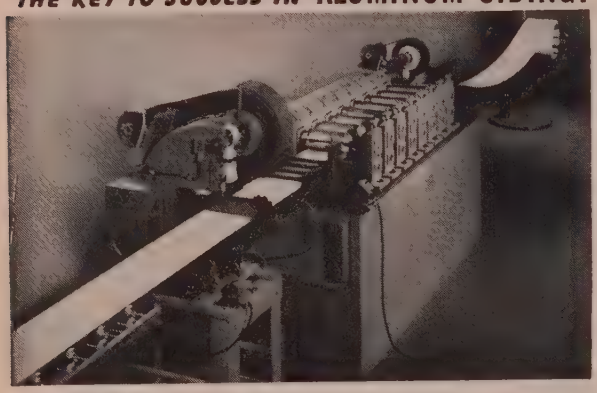

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Aviation's failure with curtainwalls (MM, April '60). It might be that Canadair's more modest monetary requirements will enable this subsidiary of General Dynamics to make the most of this effort. We hope so.

Compacts on The March » » The reaction in Detroit which we forecast in these columns this time last year is picking up momentum. To the original Big Three compacts will be added Chrysler Corp's Lancer (Dodge Div'n), General Motors' Tempest (Pontiac), the F-85 (Oldsmobile) and the Special (Buick). We read somewhere that Cadillac, smarting from the punishment dealt out by the four-seat T-Bird, is readying some kind of a sport model for introduction in 1961. At the same time, car builders are starting to trim inches off some of their standard makes. This is good news to motorists. Even better news is the plan to use aluminum V-8 engine blocks in the three new GM compacts. Unlike steel, which stands to lose by the gradual shrinking of car size, aluminum forges ahead, benefits by the growing popularity of compacts and smaller cars generally.

Wave of the Future » » "Conakry," "Inga," "Fria," and "Volta River," — meaningless terms to most people today — will one day stand for Africa's aluminum industry the way "Detroit" now connotes the auto business. F. Weston Starratt, editor of the *Journal of Metals*, organ of the Metallurgical Society of AIME, quotes a top aluminum executive as saying that half of the world's entire aluminum production will be in Africa inside 30 years. Starratt himself attaches a big IF to Africa's "potentially gleaming light of immense mineral prosperity." This is the "problem of social and political stabilization as a prerequisite of economic development." The article, reviewing the fabulous resources to which the new nations of west Africa have fallen heir, cited the rich bauxite deposits and the enormous hydroelectric potential. "Starting with French and Canadian activity in this area, almost the entire gamut of major European and North American aluminum firms have become actively interested in the continent's tremendous production possibilities," Starratt said. For our part, Starratt need not have qualified his promise of Africa's future industrial greatness. Our hunch is that "the plan" is unalterable, not to be scotched, either by the present unrest and uncertainty or social or political troubles not now foreseen. The big question: When will the "plan" materialize?

Hidden Market? » » Good place to look for new users of aluminum in the U. S. is among the 5500 sheet metal shops, the 4000 welding plants, and the 3000 architectural and ornamental fabricators. These 12,500 firms have been neglected mainly because they use small amounts of aluminum. Three years ago only 2000 or so used aluminum. Today it's double that amount, and we find them an interested group of new subscribers. They are buying better equipment, hiring technicians and salesmen, and going after precision fabrication work. We estimate that nearly 4000 of these plants now consume 40-50,000 tons of aluminum annually. Some intelligent promotion could easily sell 150,000 tons annually to these plants within a couple of years.

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If you work with aluminum you'll be interested in Northwest's outstanding line of chemicals for use with modern alloys. Northwest's continuing research and development program has earned them the reputation of "First with the best" in this rapidly developing field. It will pay you to investigate:

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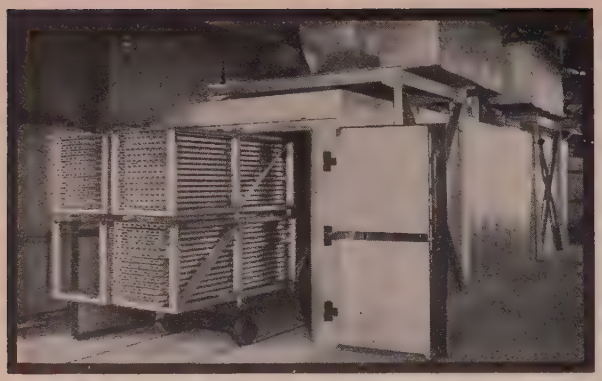

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Useful Data

Inclinable presses, series C, of E. W. Bliss Co., are detailed in data sheet 3M-4-60. Four presses have capacities of 22, 35, 45 and 60 tons. Data sheet includes all specifications of machines, along with diagrams showing outstanding parts of units. Two clutches are available, and the presses have compact electrical controls and optional inclining mechanism. Copy can be had from Edward Ferry, E. W. Bliss Co., Canton, Ohio.

Magnesium die castings and the many reasons for using them are discussed in a new illustrated booklet. It covers these arguments for magnesium die castings: More castings per pound; fast machining; cast to close tolerances. Many automotive, machine and hand tool applications are illustrated and discussed. For booklet 181-207-60, write William H. Gross, Magnesium Sales Dept., Dow Chemical Co., Midland, Mich.

Rotary benders for the forming of tube, pipe, bars, structural shapes, channels, etc., of aluminum, steel, stainless steel, copper and brass are described in a new 16-page catalog. Benders are hand or fully automatic hydraulic units, and can handle tube from ¼-inch OD to 17 inches OD. For catalog, write E. J. DeWitt, Wallace Supplies Mfg. Co., 1304 Diversey Pkwy., Chicago 14.

Crucibles for melting aluminum are covered in a 4-page folder detailing Tercod carbon bonded silicon carbide crucibles. Information includes size, height, top and bottom diameter and capacities (actual water and working aluminum). Six crucible shapes are diagrammed. Bulletin T-858 can be obtained from R. C. Wolfgong, Electro Refractories & Abrasives Corp., 344 Delaware Ave., Buffalo 2, N. Y.

Warehoused architectural aluminum is detailed and illustrated in AIA File 15-J brochure published by Reynolds Metals. Complete technical and specification information is given for structural shapes, extruded tubing, handrails, pipe rails, window sills, thresholds, bar and rod. It also contains information on alloys of plain, embossed and colored sheet available for architectural uses. Send request on letterhead to Reynolds Metals Co., Dept. PRD-25, Richmond 18, Va.

Heat-treatable titanium alloy Ti-4Al-3Mo-1V, developed to meet the requirements of high speed aircraft, is the subject of a new bulletin. Manual details physical, mechanical and design properties of this high-strength alloy, its response to heat treatment, and its fabrication characteristics. Data also covers alloy's creep resistance, dimensional stability during heat treatment, and service life. Write R. J. Waterkotte, Titanium Metals Corp., 233 Broadway, New York 7.

"The How and Why of Cold Roll Forming" is a comprehensive 800-page manual, written to help fabricators obtain the most from their roll forming equipment. Book has three objectives: To help one compute

the better the quality

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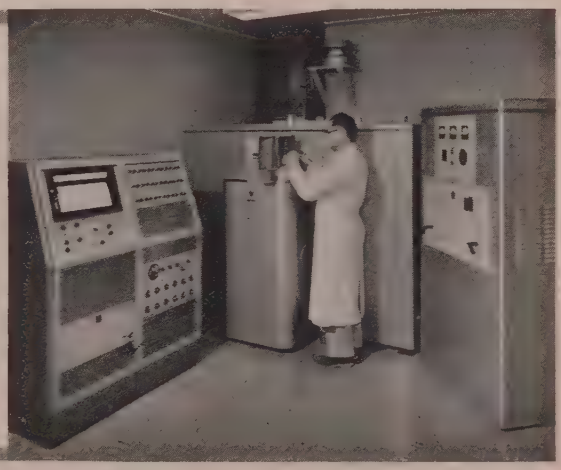
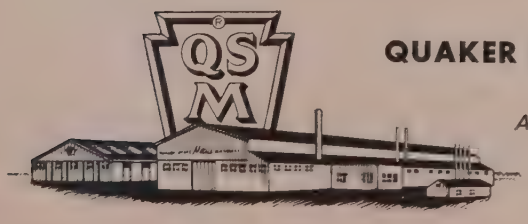


You can't afford to take chances with profit . . .

so for aluminum in sheet, coil or tubing . . . for aluminum that's guaranteed to meet your production requirements . . . for aluminum that will boost your profits, *specify* Quaker State Metals' Aluminum.



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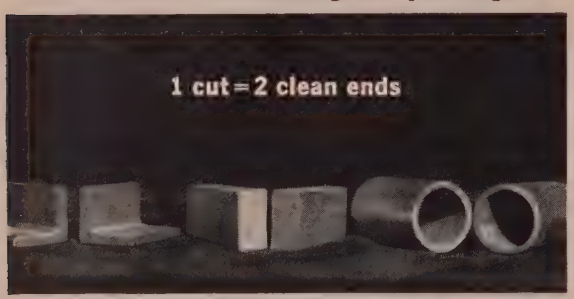

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No matter what, you get . . .
2 finished ends each time you make 1 cut.
Guaranteed? Sure! Since 1896.
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SUPPLIES MFG. COMPANY
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roll forms for a required shape and to cut costs. It also serves as a source of general information on roll forming. Book costs $15. For information write Addington Co., P.O. Box 411, Paramount, Calif.

Impact extrusion, said to be the most versatile of all fabrication methods, is covered in an attractive Alcoa publication. Information on the latest developments in the impact process is given, including increased size ranges, impact containers and the alclad impact. Twelve sections outline design possibilities, tolerances, size ranges, and application of impacts. Alcoa's impact press and secondary facilities are detailed. Copy can be obtained from Aluminum Co. of America, 724 Alcoa Building, Pittsburgh 19.

Fully automatic fusion welding equipment of the latest design is discussed in an illustrated report put out by Sciaky Bros. All equipment is shown and fully described. Also shown are applications of equipment. This 27-page book can be had from William S. Rudin, Sciaky Bros., Inc., 4915 W. 67th St., Chicago.

Pit-type recirculating furnace is detailed in bulletin SEC-10 by Sunbeam. Furnace ratings and dimensions are given for units which can be used for tempering, annealing and stress relieving nonferrous and ferrous alloys. Five advantages are listed and the furnace is diagrammed with each component pointed out and described. For a copy, contact R. K. Stephenson, Sunbeam Equipment Corp., 180 Mercer St., Meadville, Pa.

Blast cleaning abrasive performance of steel shot and Steeletts are given in a 20-page booklet, which covers four types of information: General principles; product specifications; manufacture of abrasives; and technical data. Charts and diagrams are used to explain text presented. For copy of Bulletin 903-D, write A. E. Lenhard, Wheelabrator Corp., 659 S. Byrkit St., Mishawaka, Ind.

Carbon dioxide for foundry uses is the subject of a new catalog in which 13 advantages of CO_2 are listed and explained. A special section describes flash curing for hardening cores and molds, and lists several do's and don'ts when using the process. Write Pure Carbonic Co., Division of Air Reduction Co., Inc., 150 E. 42nd St., New York 17.

"Aluminum Extruders Report" is a reprint from the July issue of Modern Metals. It covers six main points: Second half sales; average extrusion price; expansion programs; customer lists; tonnage per customer; price squeeze; purchase of molten metal. Reprint also lists the principal markets for aluminum extrusions in 1960. For copy, write Paul Messer, Modern Metals, 435 N. Michigan Ave., Chicago 11.

Stamped and pressed wing nuts are described and illustrated in bulletin "K" of Central Screw Co. Information offered includes wing spread, wing height, wing base, stock thickness and thread sizes suitable for manufacture. Pictures and diagrams of fasteners are repro-

S-E

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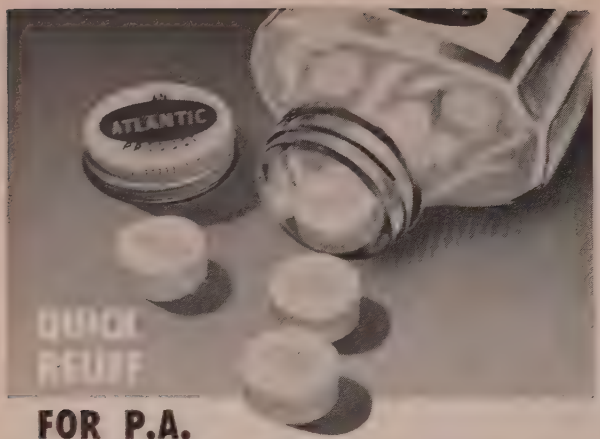

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duced and products in which they are used are shown. For copy, write E. Payne, Central Screw Co., 3501 Shields Ave., Chicago 9.

Aluminum casting alloys of Federated Metals are subject of bulletin 200. Designated PT (pressure-tight), the alloys are claimed to reduce shrinkage, improve pressure tightness, provide smooth, bright finishes, cut costs and offer consistent foundry performance. Write to E. Friedlander, Federated Metals Div'n, American Smelting & Refining Co., 120 Broadway, New York 5.

Tool and specialty steels of U. N. Alloy Steel Corp. are detailed in a new folder. Base prices are given, along with technical data for the various materials. Also included is a brand name comparison chart. For copy, write Richard Dobrein, U. N. Alloy Steel Corp., 365 Dorchester Ave., Boston 27.

Aluminum alloys currently produced by Apex Smelting are listed in brochure. Composition and heat treatment of the standard alloys are shown in tabular form, as are typical mechanical properties and other information such as electrical conductivity, impact strength, specific gravity and melting point. Request copy from A. J. Peterson, Apex Smelting Co., 2537 W. Taylor St., Chicago 12.

Bibliography of nonferrous alloys containing lithium is given in technical data sheet 202 by Foote Mineral Co. This 20-page booklet includes a brief history of lithium and discusses its alloying qualities. Bibliography was compiled as a reference to all available literature on lithium and work on alloying it with some 30 different metals. Over 300 items are listed. For copy write John Donahey, Foote Mineral Co., 18 W. Chelten Ave., Philadelphia 44.

Fluxes for casting aluminum, brass and iron are covered in bulletin 46-A by Cleveland Flux Co. Section on aluminum describes how a good metal structure is obtained with firm's flux so improved castings result. Claims — such as no fuming, no metal clinging to dross, and being able to use more scrap without danger of dirt, porous places or spongy spots — are explained. For booklet write C. B. Cornell, The Cleveland Flux Co., 1026-40 Main Ave., N.W., Cleveland 13.

Ovens and furnaces for the aluminum industry are subject of booklet by Morrison Engineering Corp. Descriptions of firm installations of complete billet and direct chill casting plants are given. Also included are details of firm's line of ageing and annealing ovens, heat treat, forge and reverberatory furnaces. For illustrated booklet write Len A. Davis, Morrison Engineering Corp., Box 4345, Cleveland 32.

Molding, casting and other PMD services for foundries are detailed in brochure describing firm's complete facilities. Plant equipment is listed and illustrated as are automated molding equipment, permanent molds and piston molds and cores. Other pages cover die casting dies, direct chill casting and centrifugal casting. Complete foundry services are listed and special equipment discussed. For copy write to William Fobbe, Permanent Mold Die Co., 2275 E. Nine Mile Rd., Hazel Park, Mich.

ALCAN extrusion ingot gives you these 4 dollar-saving advantages!

1. Better finish! 2. Greater extrudability! 3. Higher recovery! 4. Longer die-life! . . . four important reasons why ALCAN extrusion ingot may be far more economical than the billet you're now using!

How much will this better quality billet save? For an exact answer test-run ALCAN billet on your own equipment. Carefully measure its performance and true cost. See how much easier and faster it extrudes. How it reduces scrap and lengthens die-life. How it actually makes a difference in the quality of your finish.

From mining to casting—countless checks on quality make ALCAN the finest of all billet products. It is made entirely of clean, primary metal . . . unexcelled in internal structure and surface smoothness . . . and cast to the industry's closest tolerances.

Telephone our nearest office today about testing ALCAN billet on your own equipment! We welcome the opportunity to show you the difference it can make in your extruding costs and productivity.

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Extreme Accuracy— excellent safety features

"OLIVER" No. 296-D HYDRAULIC CUT-OFF SAW

Cuts non-ferrous metals and materials. Ideal production cut-off saw with high accuracy. Holds tolerances of plus or minus .001" in cutting magnesium extrusions 2" long. Features elaborate guarding around saw blade and assures deflection of chips below table. Heavy cast iron base casting gives greater capacity. Write for information.

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This space reserved for your ad. The cost is only $110 per insertion on an annual basis. And we can make up a selling ad for you. For details write to Paul Messer Modern Metals 435 N. Michigan Ave. Chicago 11, Ill.

New Enterprise

PK Klub Kart, an aluminum **golfing accessory,** not only carries a full set of clubs but also provides a place to sit. It has a built-in seat, 14 separate club compartments, zippered pockets, 12-inch pneumatic tires, and a matching hood to protect clubs. It sells for $70 and is made by BGM Industries Inc., Russell, Kan.

Electrical power linemen no longer need a "third arm" if they have a **loop deadend clip** (2412) made by the Rome Cable Div'n, of Alcoa, Pittsburgh 19. The clip is said to afford quick deadend installation because it never needs to be disassembled. It can be used on ACSR sizes ranging from No. 4 through 1/0, and for stranded aluminum conductor of comparable diameter.

Aluminum **chain link fencing,** either in open mesh or screened and interwoven with two-inch wide strips of colored, baked enamel aluminum slats, is being produced by Century Fence Co., 2021 Minor North, Seattle 2. Fencing is produced in 2 to 12-foot heights in 100-foot rolls.

A casting machine which can produce 3600 pounds of prime **deoxidizing shot** per hour has been installed at Kaiser Aluminum & Chemical Corp.'s Mead, Wash. reduction plant. Shot is used for deoxidizing steel and by firms making special nonferrous alloys. The new machine was specially designed to produce material to meet new standards of high purity shot.

A new 26,325-square-foot magnesium and aluminum **extrusion plant** has been opened by Standard Magnesium Corp. at 7501 E. 41st St., Tulsa, Okla. New equipment includes a 1500-ton extrusion press.

Development of superior alloys for **nuclear applications** will be the aim of scientists who will work in the new research building nearing completion by Atlas Titanium Ltd., Welland, Ontario, Canada. Metals to be concentrated on will be titanium and zirconium.

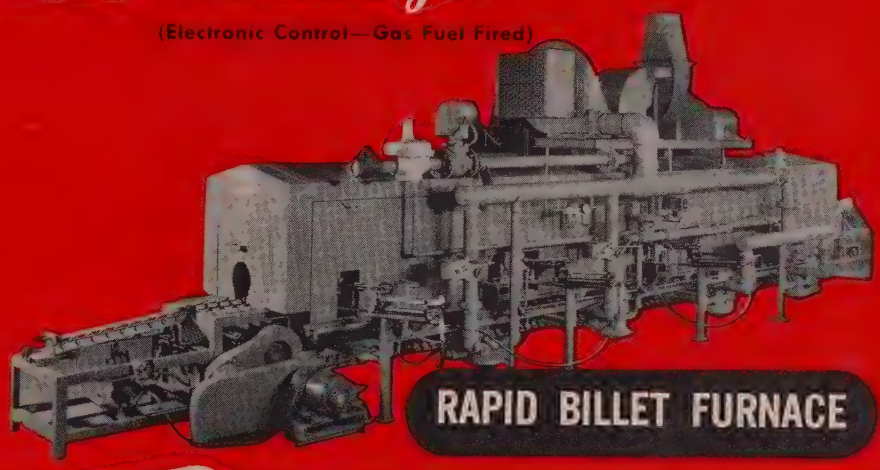
An aluminum-cased motor of a new **centrifugal pump** gives enough power to deliver 33 gpm against a 28-foot head. It is designed for chemical and corrosive liquids. The pump is made by Houston Fearless Corp., 11815 W. Olympic Blvd., Los Angeles, Calif.

An all-aluminum camp that provides everything but the campsite consists of an aluminum trailer with air mattresses, cots, utensils, a tent, built-in refrigerator, stove and storage space. At the campsite, the trailer becomes part of the 8½ by 6½ foot tent. Complete unit can be either rented or bought from manufacturer, Camp-Rite Inc., 15336 Stansbury St., Detroit 27, Mich.

Foot throttles for boats are being made of aluminum by Tempo Products Co., 2062 E. 70th St., Cleveland 3. Foot pedal and mounting unit are aluminum castings. For acceleration pedal is pushed with toe, for slowing

GRANCO *Electrogas*

(Electronic Control—Gas Fuel Fired)



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FULLY AUTOMATIC

MOST ECONOMICAL

VERSATILE

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CONTROLLED TEMP.

Electrogas is the 1960 model of the famous Granco Contact Rapid Billet Heater. Incorporating the most modern and reliable electronic control system available, it is the only completely automatic billet furnace.

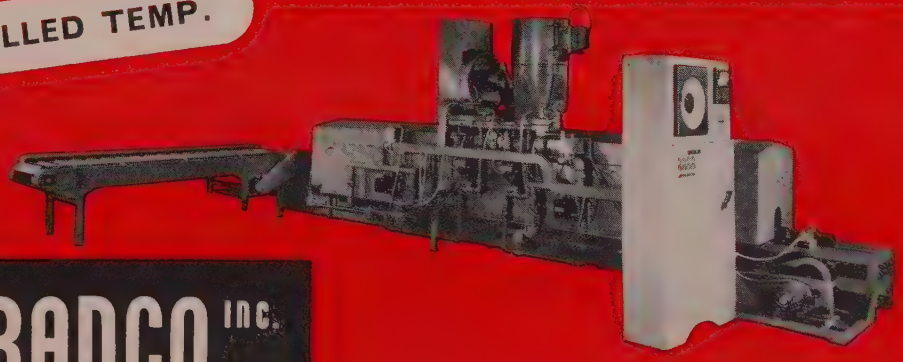
Electrogas is easily adapted to any style or make of extrusion press; can be fired with any type of gas at far less operating cost than other heating media; does not require expensive water installations.

Electrogas produces more uniform heating of billets at any conventional extrusion temperature, and/or any billet size within the size range of the model—without time-consuming changing of coils.

Electrogas is being used in the extrusion plants of almost all of the primary aluminum producers; is the ideal replacement for old-fashioned soak type furnaces in smaller extrusion plants.

Electrogas offers you many cost-cutting advantages—operating economy, low installation cost, low maintenance cost. *We have the installations to prove it—let us show them to you.*

Write today for detailed cost comparisons.



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THESE SECTIONS WERE PRODUCED ON OUR DIES

15 years of die-making "know-how" is tooled into every die . . . your assurance of highest-level production, lower cost and *fastest deliveries!* For complete die satisfaction, call SUPERIOR.

Aluminum Sections by General Extrusions, Inc. from Superior Dies

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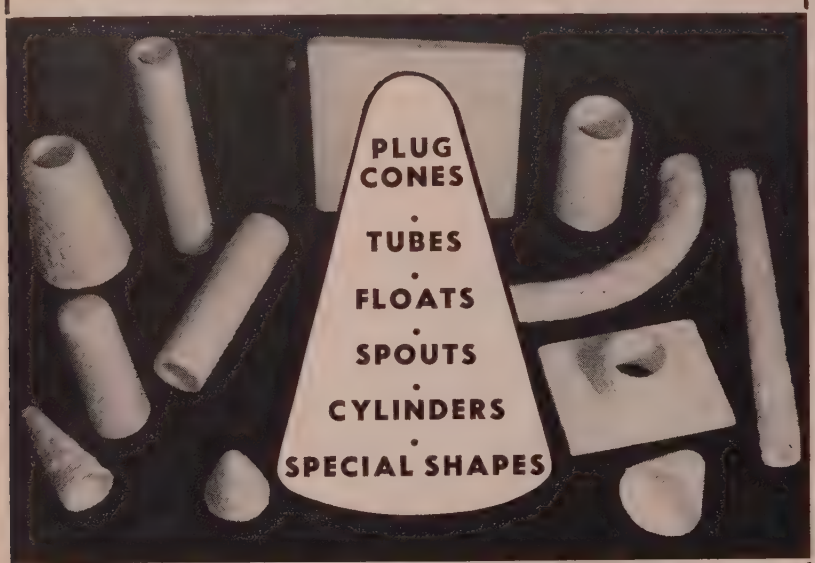

Cones to fit Tap Hole Plugs in aluminum melting furnaces — resilient — labor saving — economical — give a positive seal — cleaner melting. WRP®-X products not wet by molten aluminum withstand in excess of 2000° F. *Send for new brochure.*

REFRACTORY PRODUCTS CO.

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it is pressed with heel. The unit fits any hull contour and uses standard cables.

One thousand **Mighty-Mite bodies** and components are being produced by Twin Coach Co.'s newly formed Special Product Div'n, Waverly, N. Y., for American Motors Corp. Contract for the Mighty-Mites, a four-wheel jeep-like vehicle made largely of light metals, totals $650,000.

An electrical cable to speed and simplify installation in homes and small industrial plants has been developed by Southern Electrical Co., conductor manufacturing unit of Metals Div'n of Olin Mathieson Chemical Corp., New York 22. Cable has insulation that can be produced in weather-resistant colors so various voltage phase wires can be permanently identified. Cable is produced by special process which compresses aluminum strands to eliminate spaces between them.

A new plant and adjoining sales and administrative facilities have been completed by Nesor Alloy Products Co. at 666 Passaic Ave., West Caldwell, N. J. The company produces **fine drawn wire** in all ferrous, nonferrous and precious metals.

New extrusion plant facilities of Fetter Bros. Aluminum Mfg. Co., Jeffersonville, Ind., are in full operation. The company now has 215,000 square feet of manufacturing space and has added a new 1650-ton Sutton Engineering Co. extrusion press and related equipment.

Heli-Coil Corp., Danbury, Conn., has acquired the assets of Phelps Mfg. Co., Westport, Conn. Sale was for cash and royalties to be paid on items manufactured and sold under patents which Heli-Coil will acquire from both the company and Guy Phelps Dodge, president. Phelps manufactures **screw machine bushings** used as fasteners by industries fabricating light metals and plastics.

New president of Shingles, Inc., manufacturer of **aluminum shingles** headquartered at 4729 Maple Ave., Dallas, Tex., is Rebecca C. Allred. She will also serve as president of a wholly owned subsidiary Aluminum

HOMOGENIZING FURNACE

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for
- Uniform treatment
- Rapid Heating Cycles
- Economy of Initial Cost and Operation

LANLY HI-TEMP PANELS are operating at temperatures up to 1250° F. Contrasted with conventional brick construction, they afford the following:

Lower initial material investment cost.
Lower installation cost.
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Lower operating cost.

The development of LANLY HI-TEMP PANELS made possible this aluminum billet homogenizing furnace.
Available in either hot car or car bottom type, it is representative of the many Lanly installations in the light metals industry.

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Lanly custom designed equipment of panel construction is available for a wide variety of heat processes.
Bulletin No. 480 entitled, "Lanly and Light Metals" pictures several of them.
Write for your copy.

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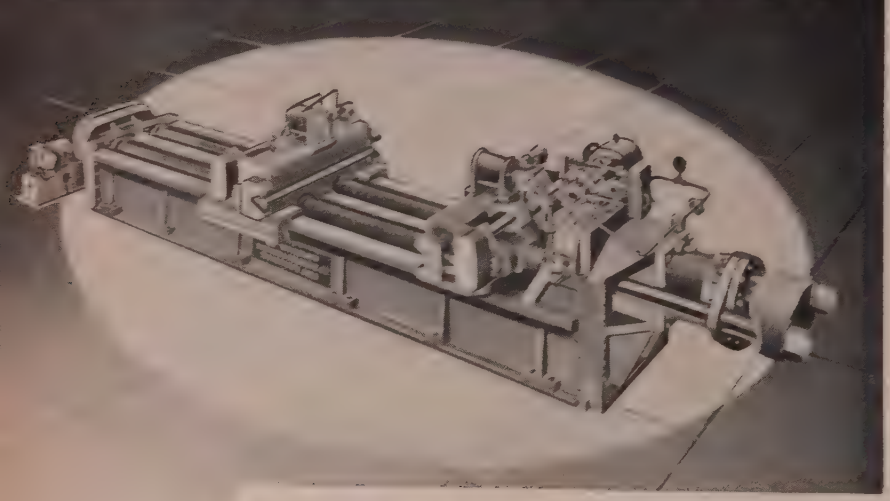
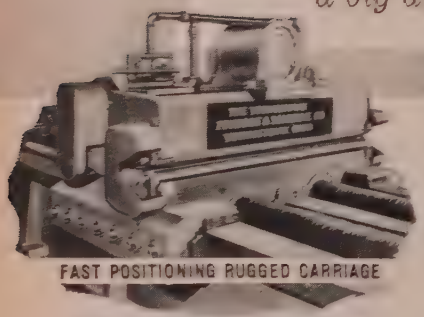
"YOUNGSTOWN"

New Carriage-Type Design

STRETCHER LEVELER



a small difference in design makes a big difference in RESULTS...



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WEDGE TYPE HEADS with WAFFLE TYPE GRIPPER JAWS assure flatness of sheet-ends

Rugged Three Way fabricated Steel Bed insures utmost rigidity

- CONSERVES VALUABLE FLOOR SPACE
- SPEEDS STRETCHING OPERATION
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This Hydraulic Stretcher Leveler is built in a complete range of sizes . . . capacities from 10,000# for aluminum extrusions to 4,000,000# for stretching plate.

75 years of heavy machinery experience is your assurance of "YOUNGSTOWN" dependability. Consult us whether your need is for auxiliary extrusion equipment, presses, or a complete extrusion plant. Write for detailed information.

The Youngstown Foundry & Machine Company

Serving Industry Since 1885

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Lifetime Shingles of Texas, a distributor and applicator of shingles.

Ground has been broken in Atlanta, Ga., for a new 55,000 square foot **distribution center** for Reynolds Aluminum Supply Co. The new warehouse will be on a five acre plot at 1530 Ellsworth Drive, N.W. It will increase the company's Atlanta facilities by 61%, and will carry a line of more than 30 aluminum building products.

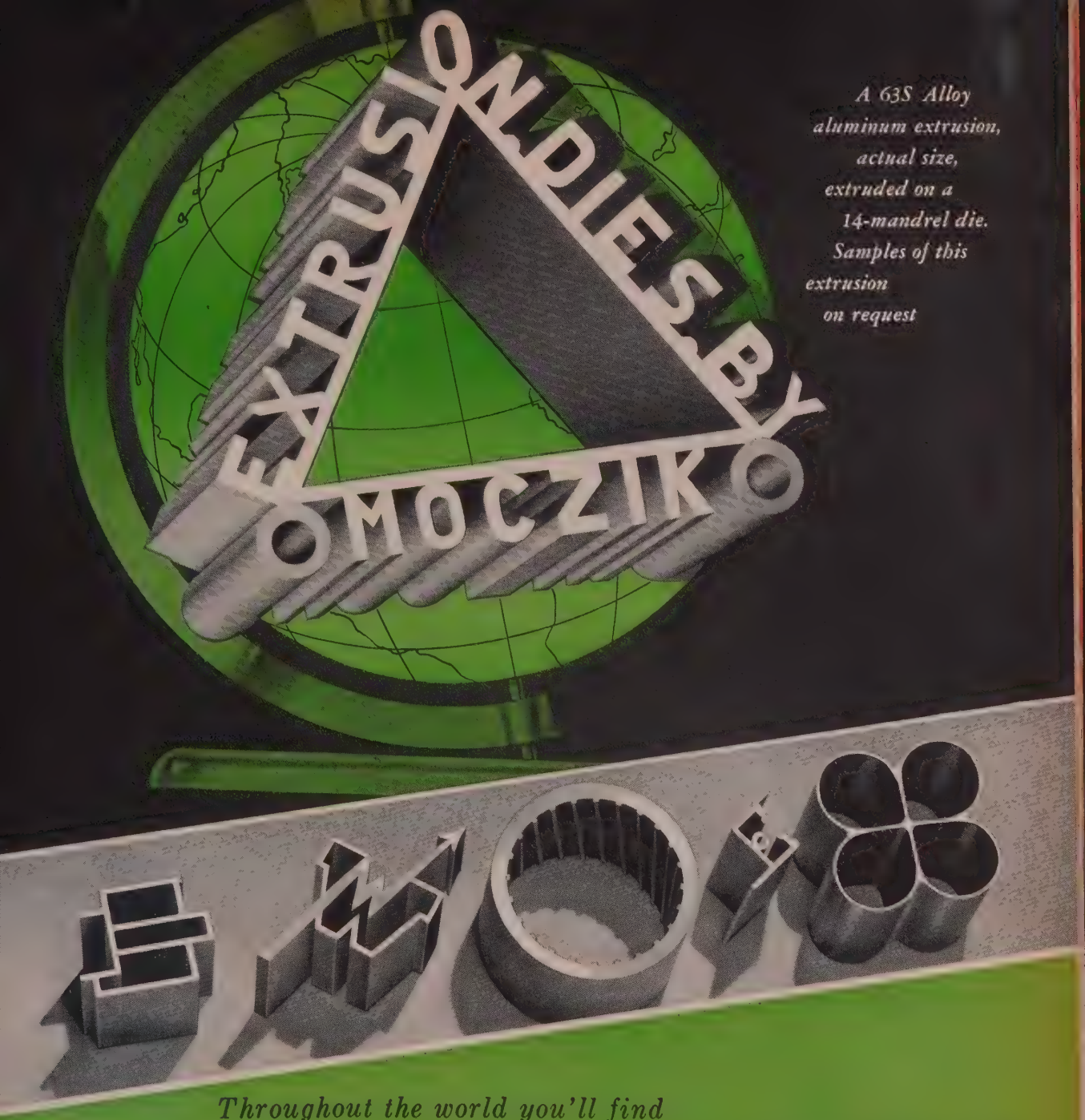
Present production of Alumo Products Co., Brooklyn manufacturer of **storm windows and doors,** will be increased five-fold by its recently completed 15,000 square foot plant at Mt. Carmel, Pa. The company now has six factories on the east coast.

Aluminum checkvalve has cage mechanism said to restrain O-ring from washout and offer dead-tight sealing and chatter-free operation. Circle Seal Products Co., Inc., 2181 E. Foothill Blvd., Pasadena, Calif., manufactures the checkvalves. Firm says they can be used for high pressure gas or liquid services where extreme surge flows are encountered.

Fast, economical delivery of fowl and animal feeds are claimed for new line of Feed Piper pneumatic **bulk trucks.** Sprout, Waldron & Co., Inc., 36 Logan St., Muncy, Pa., says weight savings range from 1000 to 2000 pounds, depending on model. Sides, roof and inlet hatches of tank are made of aluminum. Models range from 440 to 1300 cubic foot capacities.

Polished 1-inch aluminum tubes frame the **outdoor furniture** line—Sun N'Sand—of Vincent-McCall Co., Kenosha, Wis. Line includes double seat-gliders, stack chairs, adjustable posture chairs and chaise lounges. Webbing is of Saran which comes in five colors.

Portable folding tables, chairs and ladders are made of aluminum by Universal Converting Corp., 417 Sawyer St., New Bedford, Mass. Main users of arm and bridge chairs and 2½ by 6 and 2 by 5-foot tables are schools, offices, churches, clubs, etc., says manufacturer.



A 63S Alloy aluminum extrusion, actual size, extruded on a 14-mandrel die. Samples of this extrusion on request

Throughout the world you'll find

EXTRUSION DIES *by* MOCZIK

Pictured above are some intricate shapes, thought to have been impossible to extrude . . . Yet MOCZIK manufactured the necessary dies and these shapes are now production items. For your more difficult shapes, as well as the less complex solids and hollows, *come to MOCZIK.*

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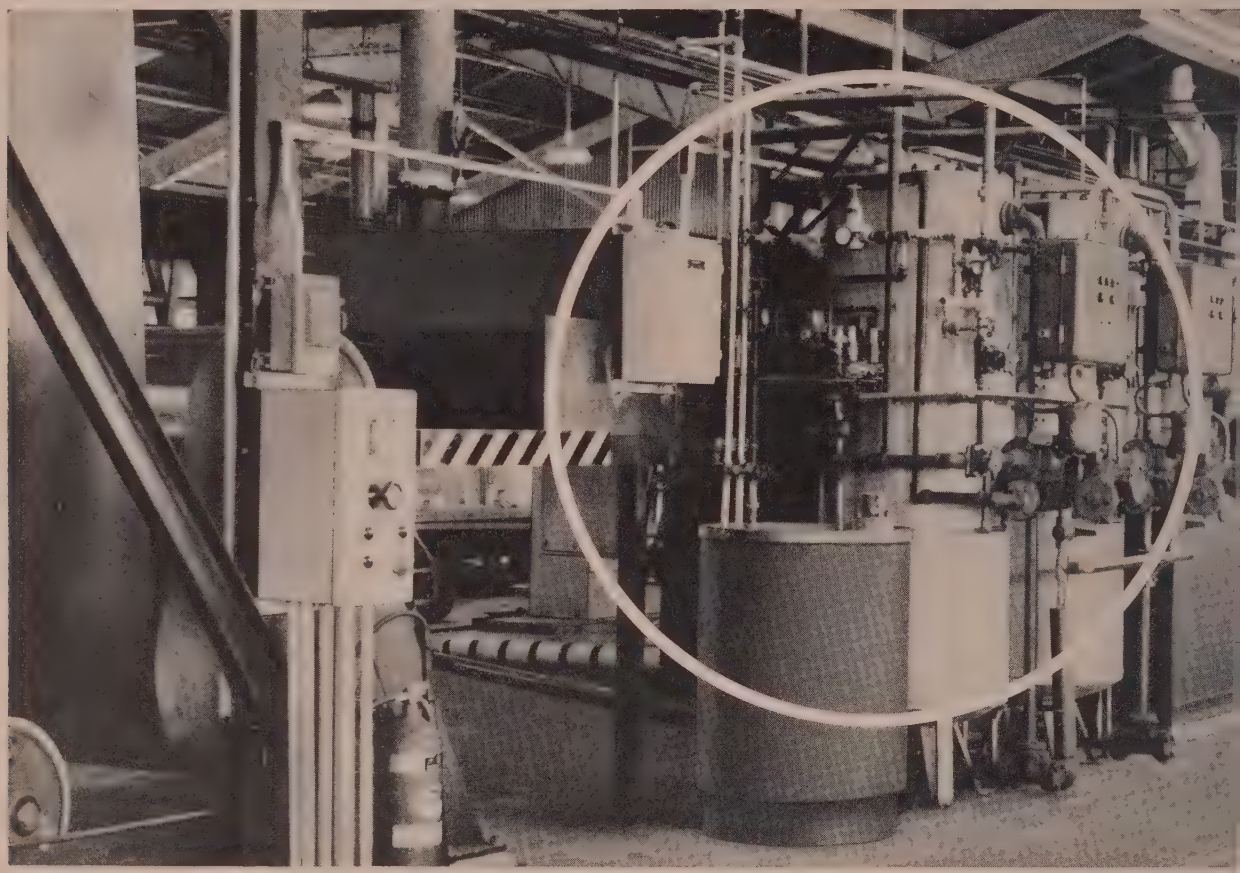
NOW! A QUALITY for BONDERITE coatings



This quality control center solves a serious production problem — the build-up of contaminating reaction products in the processing solution on high production strip lines for conversion coatings on aluminum.

It eliminates the formation of sludge and the need to dump the coating bath, ever.

It results in:

(1) Uniform quality
(2) Positive solution control
(3) Reduction in rejects and downtime
(4) Reduction of chemical consumption because the coating bath operates at low concentration
(5) Minimum sewage disposal problem

How Parker Reactifier maintains quality

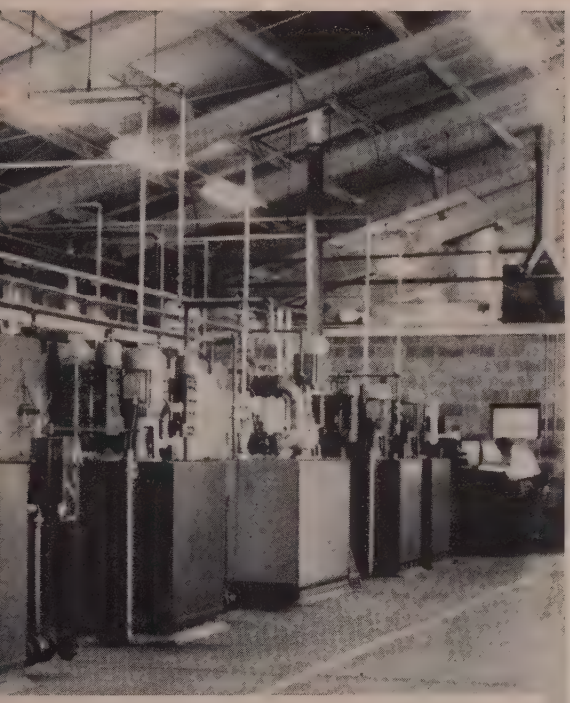
As aluminum is treated in any conversion coating solution, there's a build-up of reaction products, mainly aluminum and trivalent chromium, in the bath. Continued operation without removal of these impurities means slower coating action, sludge formation, and irregular and inferior coatings.

The control or removal of the interfering impurities stymied manufacturers for years until Parker developed the Parker Reactifier for use with Bonderite in high production aluminum lines.

The Parker Reactifier is an ion exchange unit connected in the circulation system of the processing solution. As Bonderite flows down through the cation resin bed in the Reactifier, aluminum and chromium are removed and the purified Bonderite is re-

CONTROL CENTER

on high production aluminum strip lines



This Bonderite installation at Kaiser Aluminum's Ravenswood Works, Ravenswood, West Virginia, handles aluminum strip up to 66 inches wide. Tandem Parker Reactifiers remove contaminants from the Bonderite solution as they are formed, keeping coating quality at a constant high level.

The Parker Reactifier, "Quality Control Center" of Bonderite for aluminum on high production strip lines. Bonderite enters at "A"; resin "B" removes impurities by cation exchange action; purified solution is returned at "C." Regeneration of the unit is accomplished by circulation of acid from tank "D" to cleanse resin of accumulated impurities.

turned to maintain the coating bath at top efficiency.

Proven by years of use

One Parker Reactifier has been in continuous use for over three years on a Bonderite high production aluminum strip line. In all that time there has been no deterioration of the cation resin, no sludge build-up, and no reason to discard the bath. This manufacturer now is installing a second strip line for Bonderizing aluminum with another Parker Reactifier for quality control.

In the comparatively short time Parker Reactifiers have been available, the largest manufacturing and fabricating plants have installed 30 of them to assure high quality coatings on aluminum.

You'll be proud of the finish on your product when you use Bonderite before painting. It improves paint life five to ten times. Call in the Parker man today!

Bonderites for aluminum meet MIL-C-5541 specifications.

Parker Rust Proof Company
2198 E. MILWAUKEE, DETROIT 11, MICHIGAN

BONDERITE corrosion resistant paint base • BONDERITE and BONDERLUBE aids in cold forming of metals • PARCO COMPOUND rust resistant • PARCO LUBRITE—wear resistant for friction surfaces • TROPICAL—heavy duty maintenance paints since 1883

Since 1914—Leader in the field

*Bonderite, Bonderized, Bonderlube, Parco, Parco Lubrite—Reg. U.S. Pat. Off.

Since 1914 — leader in the field

Aluminum Pricing: Up, but Lacking Stability

Modern Metals survey reveals industry wants higher prices, tighter credit controls, higher ethics; but above all, positive leadership.

SOME small measure of sanity returned to aluminum pricing practices early last month when the primary producers raised the prices of most mill products. The increases were nominal, at best, (see table of typical prices), but there was some doubt as to whether the industry as a whole would hold the line.

But the move was widely interpreted as a long-overdue attempt on the part of the primary producers to halt the 2½-year epidemic of price cutting that has made a mockery of the price book and squeezed the profit out of most mill products.

Alcoa started it in July by announcing "upward adjustments are being made in certain grades and sizes of aluminum ingot and in most aluminum mill products." Actual increases were not revealed, but they averaged ½ to ¾ of a cent a pound.

The Reason Given

"The increase . . . is directly related to increased labor costs due to the approximately 11½ cents an hour wages and benefits . . . as a result of the terms of three-year agreements negotiated in 1959," Alcoa explained. Both the increased labor costs and the higher prices became effective August 1.

Significantly, no increase was made in the base price of primary aluminum, which remains at 26 cents a pound. The other primary producers followed suit, and by August 11 Aluminium Ltd. announced that it was adjusting its prices for extrusion ingot and certain foundry alloys to coincide with the new schedule.

The increases did not come as a great surprise. Alcoa had boosted the price of building sheet ½-cent a pound in June, and further increases were widely rumored. When the three big producers turned in poor earnings statements for the second quarter, it became still more obvious that price hikes were in the wind.

As for the increases themselves, a cursory study of the new schedule reveals no significant "pattern." In flat sheet, for example, increases ranged from 1/10th to 2/5ths of a cent — but only in the heavier gauges, and in smaller cut sheet dimensions. As widths increase, fewer sizes show price increases.

An exception is in flat sheet with one side bright finish. The increases here range up to just short of 4 cents a pound — perhaps the largest increase in the entire schedule.

Increases of up to a cent a pound were noted for some aluminum circles. But for the most part, the circle schedule remained unchanged.

Coiled sheet in widths from 12 to 48 inches were hiked as much as 0.6 cents a pound depending on gauge, alloy, etc. Extruded shapes (not including round tube) show increases of from a fraction of a cent to 2 cents a pound.

One man who had a hand in pricing for one of the primary producers characterized the changes as "complex." He further noted that the increases bring prices right back to where they were in 1957 or '58.

If the changes are "complex," they are also "confusing" and even "inconsistent," according to some independent fabricators who must compete with the producers in the sale of mill products.

To get some idea of what the independents think of the new schedule in particular and the pricing situation in general, Modern Metals conducted a survey of some of the leading non-integrated fabricators. We asked:

The Questions Asked:

1.) Do you think the price increase on fabricated products is a good thing at this time? If so, why? If not, why not?

2.) Was the increase enough? Too much? Inconsistent?

3.) Have you raised your prices on semi-fabs? About how much?

4.) What do your customers think of the increase? Have they raised their prices accordingly? If so, approximately how much?

5.) Any evidence that your competitors have cut prices since the increases became effective?

6.) Do you think the new prices will stick?

7.) How do you think they will affect imports? Exports?

8.) Do you expect to see additional increases once business starts picking up?

We offered to keep the respondent's reply anonymous. We will.

A Good Thing?

In reply to the first question, all but two fabricators agreed that the increases "are a good thing" for the aluminum industry. And of the two who were uncertain, one conceded that the increased labor costs justify the increases. The other seemed to think that the price on extrusions is "far too cheap . . . almost every company is either on the borderline or losing money," this east coast extruder contended.

Among those who commented favorably on the increases, a few qualified their enthusiasm. "It's a good thing," said one "if it really results in raising the general level of prices. It won't mean much if price cutting continues down to the old levels."

A sizable sheet producer declared that "the amount of the increase is not sufficient to really help the independents. All we can say is that it's a small step in the right direction."

An extruder in the midwest concurred. "The very small increase . . . was most welcome. I still think it should be more — and I'm sure the producers do too, from the looks of their last financial statements."

" No reason why the increase in price of fabricated products is not a good thing. There must be an increase in semi-fabricated aluminum products in order for the aluminum industry to

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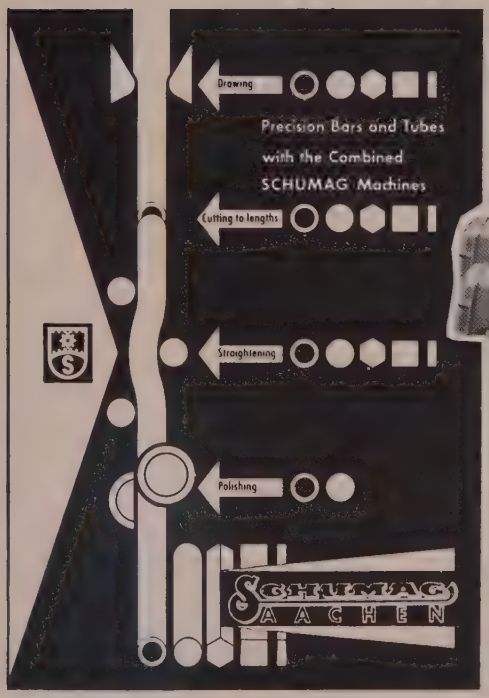

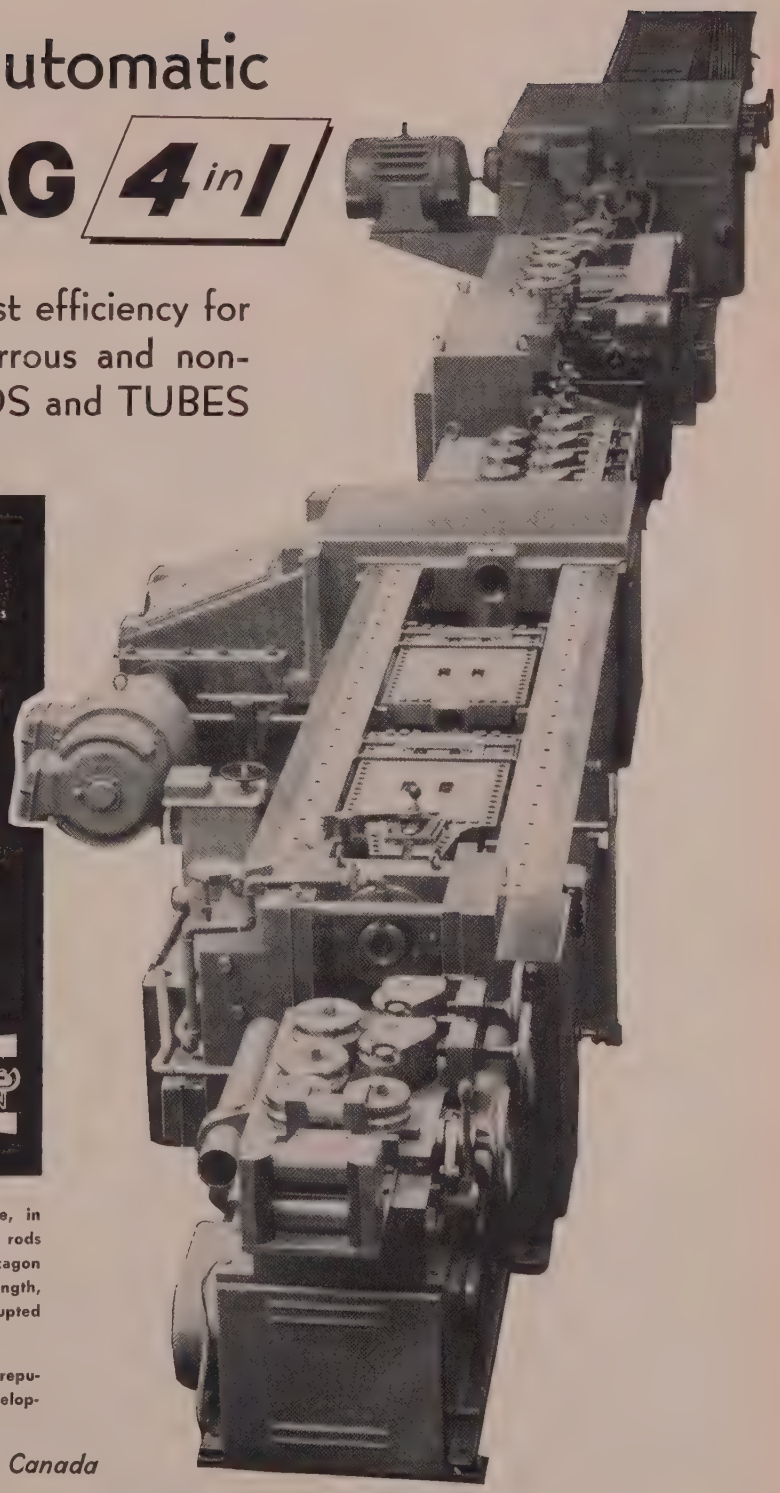

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make a profit. It is only natural to assume that the fabricated product price will have to increase. I believe that the consuming public can and will accept an increase proportionate to the increase in semi-fabricated materials," a large sheet mill stated.

Enough Or Too Much?

Answers to the second question reveal a rather wide divergence of opinion. The increases were "not enough to insure adequate return," said a spokesman for a big fabricator who is a relative newcomer to the aluminum business.

The extruder referred to above considered the changes inconsistent. "Why lower the billet price and raise the fabricated," he asked. "The Big Three should maintain better communications with Alcan," he added in an obvious reference to Alcan's earlier reduction in the price of extrusion billet.

A foil producer denounced the increases as "entirely inconsistent," noting that the prices of reroll stock and .002-inch foil were increased by the same amount — "thereby requiring the independent mills to absorb, in entirety, wage rates and other added costs."

A midwest producer of sheet and other products took a philosophical view. "Everybody would like to have a bigger spread," he reasoned, "but facts govern what you can charge for your products. A reasonable increase with some expectation that it will be maintained seems to me to be better than a new substantial increase which is fictitious."

Other comments:

"It would appear that any increases were not too much and, generally speaking, not inconsistent."

"The answer is 'no' in each case. The moderate changes in price do not cover increases in costs."

"On major volume items, our opinion is that the recent price increase was inconsistent. It was reasonable on certain specification items, but not enough on certain commodity items."

"No. It did not cover the increased cost."

Nearly all of the independents who answered our questionnaire reported that they have raised their own prices. A few seized the opportunity to make some additional comments.

"We tried to raise our prices on semi-fabs, but had no success whatever," complained our eastern extruder. "You must remember that we generally sell in areas on which the primes concentrate. We don't have much competition from other independents."

Another extruder noted that "we have used Alcoa's price list since the inception of our company." But this company does not try to meet the commodity pricing of the producers. "I firmly believe that the small independent can operate more efficiently than any of the large concerns . . . yet it is impossible for our company to sell at . . . commodity prices."

Few of the respondents could give any indication of customer reaction to the increases. As a west coast fabricator put it: "It is too early to give much information on either customer reaction . . . or whether or not customers are raising their prices. In view of the very small percentage of increase, our initial belief is that most customers will hold the line . . ."

A rolling mill in the south expressed his belief that customers would be tolerant, but added that "most of them try to absorb increases by cutting corners — cutting the gauge a little bit . . ."

SOME REPRESENTATIVE PRICE INCREASES

Building sheet — 100,000-pound base, coiled

	OLD	NEW
.032" x 12"-48" wide	37.3c	**37.8c**
.024" x 12"-48" wide	37.8c	**38.3c**
.019" x 36.01"-48" wide	39.3c	**39.3c**

ALLOYS 1100, 3003 and 5005 30,000-POUND BASE

Flat sheet, mill finish

.125" x 24" x 72"	45.5c	**45.9c**
.048 x 48" x 96"	47.3c	**47.4c**

Coiled sheet, mill finish

.019" x 24" wide	44.6c	**44.8c**
.006" x 24" wide	56.2c	**56.5c**

Flat sheet, one side br. mill fin.

.030" x 48" x 96"	54c	**56.2c**
.006" x 24" x 72"	68.8c	**72.7c**

Coiled sheet, one side br. mill fin.

.077" x 24" wide	43c	**43.6c**
.017" x 12"	46.9	**47.6c**

ALCLAD 3003 — 30,000-POUND BASE

Flat sheet, mill finish

Std. tempers O, H12, H14, H16, H18

.096" x 24" x 76"	47.3c	**47.5c**
.038" x 36" x 96"	49.5c	**49.5c**
.030 x 60" x 180"	57.1c	**57.1c**

Flat sheet circles, mill finish

Std. tempers O, H14, H-16

.125" x 48" dia.	50.4c	**51.4c**
.024" x 48" dia.	56.1c	**57c**

ALCLAD 2014

Plate, plate circles, (var. alloys) 30,000-POUND BASE

.250" x 36" x 96" (1100F)	44.6c	**44.6c**
.500" x 48" x 240" (3003 H112)	44.9c	**44.9c**
1.00" x 48" x 272" (Alclad 3003F)	48.2c	**48.2c**
.250" x 72" dia. (Alclad 3003 H112)	53.1c	**54.6c**
2.500" x 48" dia. (5050F)	50.5c	**50.5c**
1.500" x 96" dia. (3004O)	56.5c	**56.5c**

Extruded round tube, straight, var. alloys, tempers; 30,000-pound base

1¼" O.D. x .050" (6063 T4)	81.3c	**82.8c**
2" O.D. x .061" (1100F)	61.6c	**62.7c**
4⅛" O.D. x .062" (6063 T6)	65.5c	**66.5c**

Drawn tube, 30,000-pound base lengths 3 to 30 ft. (var. alloys)

¼" O.D. x .015" (3003 H18)	$3.32	**$3.40**
1" O.D. x .020" (6062 T6)	134	**1.36**
2" O.D. x .027 (6062 T6)	1.52	**1.55**
Rounded Corners		
½" Square x .025 (3003F)	1.48	**1.51**
¾" Square x .027" (3003F)	1.27	**1.29**

Rounds—Wire and Rod

0.374"-0.314" dia. (1100)	45.5c	**45.9c**
0.0126" dia. (5056)	90.8c	**92.4c**
1/16" dia. (4043-H18)	65.7c	**66.8c**
2.500"-2.001" dia. cold finished (2011-T3)	52.1c	**54.1c**
2.000"-1.625" dia. cold finished (2014-T451)	59.2c	**60.4c**

These answers are typical:

"We have had no complaints from our customers in connection with increased prices. In many cases, customers have not increased their prices and, where they have, the increases are relatively small."

"Customers' reaction to the price increase is amazement. They cannot understand why the industry raised prices under existing market conditions. No reaction on whether they will raise their prices since buyer consensus is that with present competitive conditions they should be able to limit the amount of increase they will accept."

"We believe our customers understand that the increase was necessary and justified."

Only two of our informants reported any price cutting. "The market is very fluid and prices have both increased and decreased," commented an extruder. "Certainly price cutting is continuing, but possibly from a slightly higher base," opined another.

Several of those who could not report any price cutting took pains to emphasize that they had no *actual evidence* of price cutting.

Will They Stick?

"Do you think the new prices will stick?" our sixth question asked. "Probably — for a few months, at least," said a producer of extrusions. "I don't think there are new prices, and the question is academic," said another. "Unless the Big Three would like to see their margin go lower we believe the price will remain and very possibly increase on certain items not produced by independents," said still another extruder.

"It is difficult to forecast as to whether

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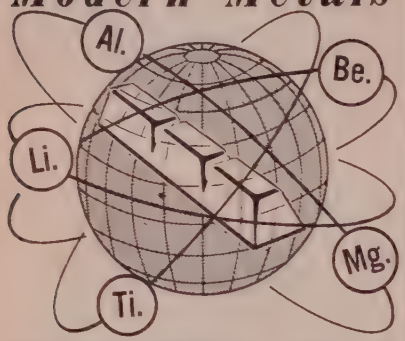

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the new prices will stick. Obviously, from the past experience the aluminum industry lacks mature leadership. In face of decreasing profits, there appears to be a scramble to obtain business at any price, and at least one primary producer today probably has more commodity prices than regular prices. This is extremely unhealthy, industry wise, and tends to break down general price structures. Also, increased difficulties are apparent because of building sheet prices. Many customers who have been discriminated against because of gauge deletions are extremely concerned, and rightly so. Without a doubt, the entire building sheet program should be deleted from the price structure. It appears difficult to delete, even in view of the decreased profits, possibly because of loss of face," said a sheet mill.

Most of the other fabricators thought the new prices would hold, but a few frankly stated that they did not know.

On the subject of imports and exports, a foil producer noted that "the price spread between imported and domestic foil is already so great that imports may very well continue to grow. While the recent price advances may encourage this trend, they will at least permit domestic producers to increase profits on the foil they do sell . . ."

More Increases Coming?

Our final question asked if the fabricator expected any additional increases once business starts picking up. "It's difficult to guess," said the foil man quoted above. "Presently there is no indication of a major boom in the aluminum business. and I doubt whether there will be more than minor price adjustments for a considerable period of time."

"The aluminum industry must show a sound earnings pattern in order to warrant investors' confidence and in order to get their money for improvement of facilities," he explained. "On this basis we would say that further price increases will come along as business improves," said a wrought aluminum producer.

The "philosopher" quoted earlier was dubious. "I think the economic facts of life prevail pretty generally throughout the metals industry now — particularly in steel and aluminum," he observed. "I believe the two industries will keep each other honest, as it were. I don't think the competition is particularly between producers within a given industry these days, so much as it is between industries."

Whether he intended to or not, this inveterate seer fingered the very factor that could be the undoing of the producers' attempts to hike mill product prices to profitable levels.

Steel Moves Back Into Conduit

On September 1 steel producers showed unmistakable signs of meeting the challenge of aluminum. Makers of galvanized steel electrical conduit shaved 5% off their prices. This looked like a belated answer to the commodity priced aluminum conduit that was brought out by the aluminum producers early this year — which everybody expected.

Alcoa had tried to include conduit in its general price increases August 1, but rescinded the action when the other producers didn't follow suit. In response to the lower price of galvanized conduit, Kaiser Aluminum chopped its price by 5% and Alcoa, Reynolds and others met the new price.

Result: Aluminum conduit is now pegged 5% below the July 31 level and 10% under what it would have been had Alcoa's increase been followed. As a spokesman for one moaned: "This new price will barely pay for the labor." Said another, "Now we trade money."

Can Stock Prices Slashed

The aluminum producers were confronted with another king-sized hunk of reality a few days later when U. S. Steel announced its new "Ferrolite," a thinner gauge tinplate that was obviously tailored to choke off aluminum's invasion of one of steel's biggest and oldest markets—the canning business.

The aluminum producers had commodity-priced themselves into the can business — "they're practically giving the stuff away," some say—but U. S. Steel's new "thin tin" is priced at from $6.10 to $6.65 per base box compared with the $9.10 on conventional tinplate.

It's too early to tell what this will do to a once-promising market for aluminum. But the next move is up to the aluminum companies. Regardless of what they do, it's obvious that the real pressure on prices will come from outside the industry from now on. Regardless of the outcome, those users who switched from steel to aluminum via the commodity bandwagon are about to get the cheapest steel and/or aluminum they ever dreamed of.

Back in the late forties a minor recession developed and steel firms were cutting prices like the stuff was going out of fashion. As the story goes, Ben Fairless, then head of U. S. Steel, had a talk with his competitors. He advised them that U. S. Steel would meet every price cut; that it would also make the *last* cut — if necessary. He suggested, we were told, that his company could almost give the stuff away and last longer than any competitor. He said U. S. Steel was ready to start the very next morning. The next day, steel prices firmed considerably. *It might work* with aluminum.

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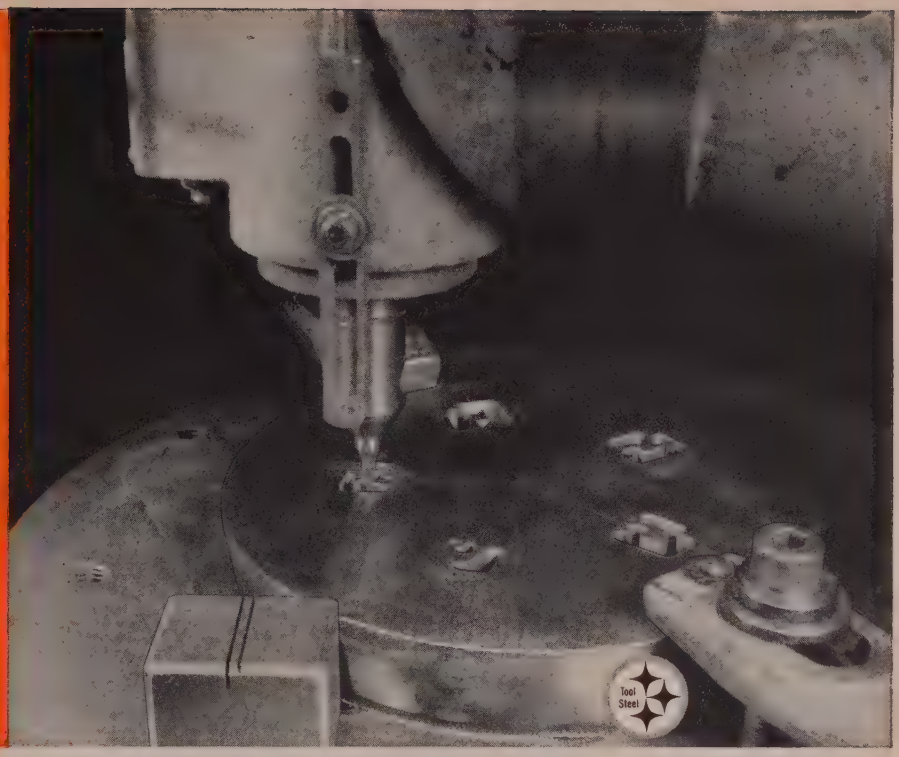

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New Refractory May Reduce Aluminum Production Costs

Norton engineers also term material suitable for melting furnaces, other uses.

SILICON carbide crystals can be bonded with a complex nitride to form low-cost refractory brick that is strong, durable, and resistant to the corrosive attack of molten nonferrous metals encountered in production, melting, holding, transferring, etc.

This is the claim of the research and development department of Norton Co., Worcester, Mass., developer of a new refractory called Crystolon 63. The firm says this product was developed primarily as a lining for aluminum reduction cells, but that it has other important metal industry uses.

Some suggested uses, in addition to cell linings, include remelt furnace refractories; metal transport and furnace auxiliary devices such as trough tile, pyrometer tubes, etc.; tube assemblies for induction furnaces; and crucibles for nonferrous melting.

And Norton lists still other uses of Crystolon 63: High strength kiln furniture; incinerator linings; refractories for the handling of corrosive salts; and reactor linings.

There are other products on the market similar to Crystolon 63. But, according to Norton, "all of these products are priced in the same class as exotic refractories. Crystolon 63 is the first which will have a price structure within economic reach of most industrial applications."

Silicon carbide results from heating clay and coke. A reaction occurs during the vapor stage at 4352°F to form hexagonal crystals. They are hard (2000 on Knoop scale; diamonds are 8000), and stable at high temperatures (melting point is 5126°F). Refractories made from these crystals resist oxidation when heated because of a protective coating of silicon dioxide on the crystals.

Crystolon 63 is formed by bonding these small, hexagonal crystals together. The bonding agent is very important to the ultimate use of the refractory because it holds the crystals together both chemically and mechanically. Chemically it incorporates the silica film on the crystal and mechanically it forms rigid pockets in which grains are held.

Versatile? — So It's Claimed

The new refractory can be used in both structural and corrosion resistant applications. Oxide-bonded refractories are less expensive, but cannot be used in aluminum reduction cells because cryolite (the electrolyte used) is a solvent for most oxides.

Norton's goal was to develop a low cost refractory that would not dissolve in molten cryolite. Initial examination produced 14 variables. Combinations were selected at random, the variables were narrowed down, and after 120 tests Norton found what it termed one "outstanding" complex nitride-bonded silicon carbide combination. It was named Crystolon 63.

Straight 9-inch brick was then made for use in further experiments. It had an unglazed marbleized surface, uniform interior, and density of 2.6 g/cc.

This new brick and an oxide-bonded refractory were compared in corrosion tests. Both silicon carbide refractories were immersed in a cryolite and aluminum bath at 1832°F for two-hour cycles. The oxide bonded refractory failed after two cycles but the new brick showed only negligible corrosion after six cycles.

Next, a primary aluminum producer tested a sample brick for its original purpose — use in an aluminum reduction cell. The brick was placed in a cell for seven days and directly exposed to molten cryolite and aluminum. The brick's performance, according to Norton, enthused the aluminum producer.

In another test, the brick spent seven days in molten aluminum during which time no metal penetrated the refractory. The surface was stable and was not wetted upon contact with the molten metal. Bars were also placed in molten lead and zinc at 1112°F and "results were excellent." Other tests produced data shown in the accompanying table.

R. W. Love of Norton's research department has detailed the properties of the refractory "which give it an important place in the field of handling nonferrous metals." They are:

"**Chemical resistance** to attack by molten aluminum, magnesium, zinc, lead, etc. And because these metals do not wet or stick to the refractory, complete cleanliness can be maintained.

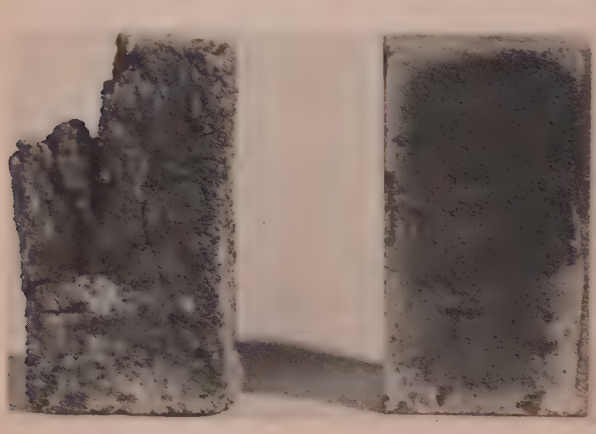
"**High strength** — important in any ceramic material for structural uses.

"**High thermal conductivity** — important for the transfer of heat in certain sections of melting furnaces.

"**Abrasion resistance** — most important in cold charging furnaces used in aluminum remelt plants where large amounts of scrap are thrown on the hearth of the furnace. (Crystolon 63 has a hardness of over 9 on Mohs scale.)

"**Flame impingement**, which is sustained to a great extent in any furnace where there are open burners, is one of the severest services a refractory can have. Crystolon 63 can withstand such flame conditions for considerable periods without any erosion."

A good example of the use of Crystolon 63 is in reverberatory furnaces used for melting aluminum. It is suggested for use as a hearth refractory where its abrasion resistance will withstand the



■ ***Shown are two silicon carbide refractory bricks after being immersed in cryolite and aluminum for 20 hours at 1832°F. Brick at left, however, was made with conventional oxide bond and was severely attacked. Brick at right is the complex nitride-bonded silicon carbide called Crystolon 63. It showed only negligible corrosion.***

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mechanical abuse of charging cold scrap and pig, and absorb the blows of 1000 pound charges being dropped from several feet onto the hearth.

Because the new refractory is not wetted or penetrated by molten aluminum or its alloy constituents, it is recommended for use at the metal-to-air interface of the furnace where the severest chemical attack occurs. The refractory's thermal conductivity makes it advantageous, according to Norton, for use in hot walls to conduct heat from the melting to holding hearth to keep metal molten.

Metal Transfer Systems . . .

The properties that favor Crystolon 63 for use in reverberatory furnaces make it suitable for metal transfer systems in casting operations, as well.

Claims Norton: "By producing tapping blocks, launders, valves, pouring nozzles, etc., from Crystolon 63, we can assure that high purity molten metal is in contact with a refractory that will not react, wet or outgas into the metal at the entrance of the casting mold."

Experiments using Crystolon 63 as a lining for aluminum reduction cells indicate that the new product can cut wall thickness 75% and thus reduce electric power requirements substantially. Three properties are considered important here: High thermal conductivity (60-80 BTU/hr/sq.ft./°F/in.); good corrosion resistance to fused salts; relatively good electrical resistance.

Aluminum reduction cells have carbon walls 8 to 12 inches thick and carbon floors more than 15 inches thick. But carbon has several disadvantages. Being a relatively good conductor, it is suspected of allowing current to be lost through the walls. Also, carbon is attacked by molten cryolite, which sometimes causes walls to expand and crack. This necessitates thick walls, which do not offer good heat flow to take excess heat from the cell.

Crystolon 63 is said to resist molten cryolite, so walls of this material could be much thinner (only 1½ inches thick) than carbon. Also, the material's high thermal conductivity would remove excess cell heat.

Norton says its refractory allows a frozen layer of cryolite to form on the sidewalls. This produces the perfect refractory situation in that the molten phase is contained by itself. But in case the ledge melts off during the time when the cells overheat there still exists a refractory that resists molten cryolite.

At present, aluminum producers in North America and Europe are testing silicon carbide sidewalls. Tests are not yet near completion. They are said to be "encouraging to date," but one major problem exists.

To allow revamping, the cell should be completely lined with Crystolon 63. This is not now possible because iron cathodes used in reduction have to be buried in the carbon floor to protect the iron from the corrosive conditions of cryolite and aluminum.

Carbon must be used for the floor because it is the only refractory with enough electrical conductivity to allow current to flow to the imbedded cathode.

Present developmental work includes making a cathode which can rest at the bottom of the cell cavity in the molten aluminum pad without being attacked. So far two materials — zirconium diboride and titanium diboride — fit the requirements. They are expensive, but Norton says methods of cutting production costs are being examined.

If the Crystolon 63 sidewalls can be teamed with diboride cathodes, two cost elements in aluminum production will be cut. First, the thick carbon floor can be replaced with a thin bottom. This, when combined with the new thin sidewalls, will greatly enlarge the cell cavity and allow more metal to be produced.

Second, electrical power costs will be reduced 15%. At present it takes approximately 10% of the voltage used to get current through the carbon floor to the cathode.

Norton claims the refractory has several other metallurgical uses, too. It can form the relatively thin, cylindrical refractory lining of high frequency induction furnaces, and can also be used as the refractory in low frequency induction furnaces.

. . . And Precision Casting

Crystolon 63 serves two purposes in the precision casting industry. It can be used for the refractory crucible in indirect arc furnaces since it is claimed that it would eliminate the chance of refractory or slag carry-over into the castings. The new composition can also form ceramic molds, which resist thermal shock when metal is poured.

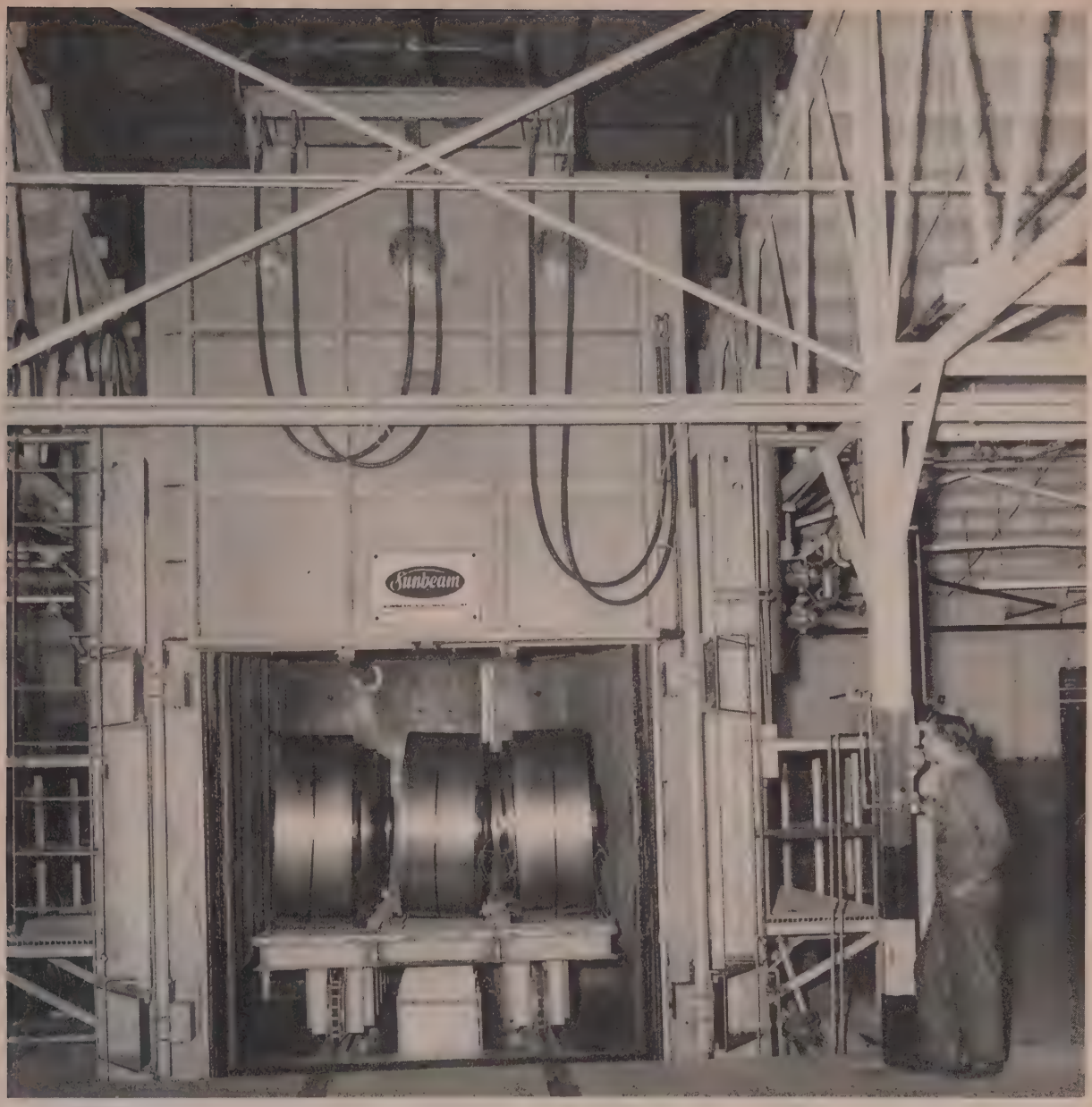
Norton says smelting operations for aluminum, magnesium and zinc can be improved with a silicon carbide refractory. "Silicon carbide is compatible with these metals and the environments encountered in their smelting operations. High strength and thermal conductivity along with thermal shock resistance are additional refractory requirements."

Its developer says Crystolon 63 is such a new product it is not yet fully commercial in all of the applications outlined. "However, in nearly every case it is being tested and these field tests are far enough advanced to prove that it has the properties and requirements to fit these applications."

Properties of Crystolon 63

Modulus of . . .	Dimensions of Test Bars	Results
Elasticity	9 by 2 by ¾ (in.)	177 x 10^{10} dynes/cm^2
Rupture at room temp.	9 by 2¼ by ¾ (in.)	6400 psi
Rupture at 2282°F	9 by 2¼ by ¾ (in.)	7000 psi
Rupture at 2642°F	9 by 2¼ by ¾ (in.)	3800 psi
Resistance to . . .	**Testing Conditions**	**Results**
Corrosion by molten cryolite, aluminum	6 two-hour cycles of exposure at 1832°F	Average volume loss was 1.1%
Attack by molten aluminum metal	168 hours at 1472°F	No wetting
Attack by molten lead and zinc	168 hours at 1112°F	No wetting or attack by metal or oxide
Oxidation Resistance	Continuously exposed to steam and air for 4 weeks at 2012°F	Change in volume was 0.00%
Wear Resistance	Sandblast penetration with No. 4 chamber and 25 pounds pressure for 30 seconds	Depth of penetration was 1.0 to 1.5mm (it is 2½ mm in granite)
Electrical Resistivity	Measured on sample 8.1 x 1.3 x 1.3 cm cut from straight 9-in. brick with one volt per cm	

Sample	Temperature	Results
Cut from interior	room	380 ohm-cm
	1832°F	2 ohm-cm
Cut from surface	room	490 ohm-cm
	1832°F	3 ohm-cm



Sunbeam Furnace holds close tolerances at American Screen Products

American Screen Products Company is the world's largest manufacturer of high quality roll formed aluminum screening. They recently installed this new SUNBEAM annealing furnace as an integral part of their reduction mill operations for processing aluminum coil.

This furnace was specifically designed to heat 30,000 pounds of aluminum coil from 70°F. to 900°F. in six hours. Temperature tolerances of plus or minus 10°F. have been maintained in the 500°F. to 1200°F. range. In addition to meeting these basic furnace specifications, SUNBEAM engineers devised a unique continuous roller chain* for carrying the furnace car in and out of the furnace. No other furnace builder offered this important design feature, which reduces the cost of maintenance and eliminates lubrication.

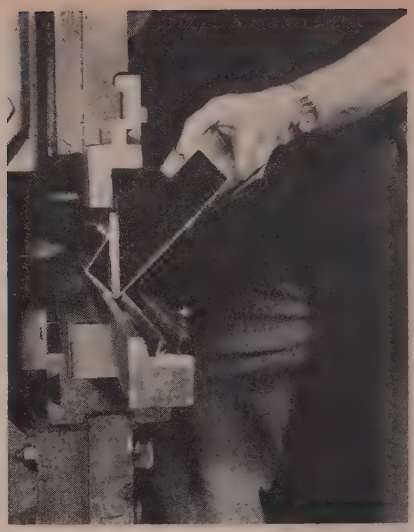
This is another case where SUNBEAM project and design engineers drew upon their vast experience with aluminum to design and build a superior furnace. This creative engineering can be yours—your key to greater efficiency . . . increased production . . a finished product of highest quality. Write or call Sunbeam Equipment Corporation, 196 Mercer Street, Meadville, Pennsylvania.

*Patent Applied For

INDUSTRIAL Sunbeam FURNACES

How To BEND ALUMINUM

This is the first installment of a two-part series covering various ways of bending aluminum and its alloys. Detailed here are classification of materials, choice of metal for bending, bending properties of aluminum and bending operations for sheet and strip. Information was supplied by the Aluminium Development Association, London, England.



■ *Press brake bending of 0.036-inch siding panels. Photo by Northern Aluminium Ltd.*

BENDING aluminum requires careful study since the metal and its alloys comprise a series of materials with a wide range of mechanical properties and varying bending characteristics.

The main difference among the alloys is the way they obtain their maximum properties. This causes them to fall into two categories: Heat treatable and non-heat treatable.

Heat-treatable alloys attain maximum mechanical properties only after appropriate heat treatment, either alone or combined with working. These alloys are of two types: Those that attain full properties after solution heat treatment; and those that require full heat treatment to gain full properties.

Artificial Ageing

Alloys that have full properties after solution heat treatment are heated for a prescribed period, then cooled, usually by quenching. This is followed by natural age hardening. Alloys requiring full heat treatment are given a solution treatment, followed by further heating at a prescribed low temperature. This is called artificial ageing or precipitation hardening.

Non-heat treatable or work hardening alloys gain hardness and tensile strength and lose ductility when cold worked. Conversely, they lose hardness and strength and gain ductility when heated to the annealing temperature. The degrees of hardness and temper in which these alloys are available are indicated by these symbols:

O — annealed.

F — as fabricated.

H — strain hardened.

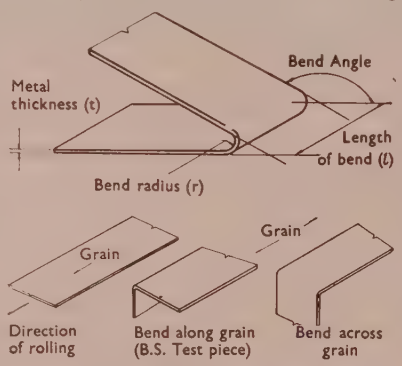
In the case of strain hardened material. the H is always followed by two or more digits, the first of which indicates a specific combination of operations. Thus, H1 indicates strain hardened only; H2 is strain hardened and partially annealed; H3 is strain hardened and stabilized.

The second digit indicates the final degree of strain hardening. Thus, H12 is ¼-hard; H14 is ½-hard; H16 is ¾-hard; and H18 is full-hard.

The choice of alloy and the form required usually depend on the product's purpose and the desired mechanical strength, fabricating properties, corrosion resistance and finish.

Work samples are the most reliable guide to bending characteristics, but a guide to the minimum bend radius of a material can be obtained from routine bend test values. This is only a laboratory quality control test, however, and probably will not represent the results of wider parts used in actual production.

A good method of determining the ductility of soft metals is the flattening test. Here, a vise is used to bend sample strips through 180 degrees. However, only a skilful operator can get reliable data from this test.



■ ***Figure 1 illustrates some terms used in bending. Metal thickness (top drawing) is referred to as T. This symbol is used in defining bend radius (r), which is a multiple of the thickness (e.g. 2T). Bottom shows grain direction of rolled metal. This is somewhat insignificant in bending aluminum, though bending across grain sometimes eliminates problems encountered when bending with it.***

When severe bending or flanging is needed, alloys of special quality can be obtained. These alloys are of normal composition but are treated to develop to a maximum the properties required for rigorous bending conditions.

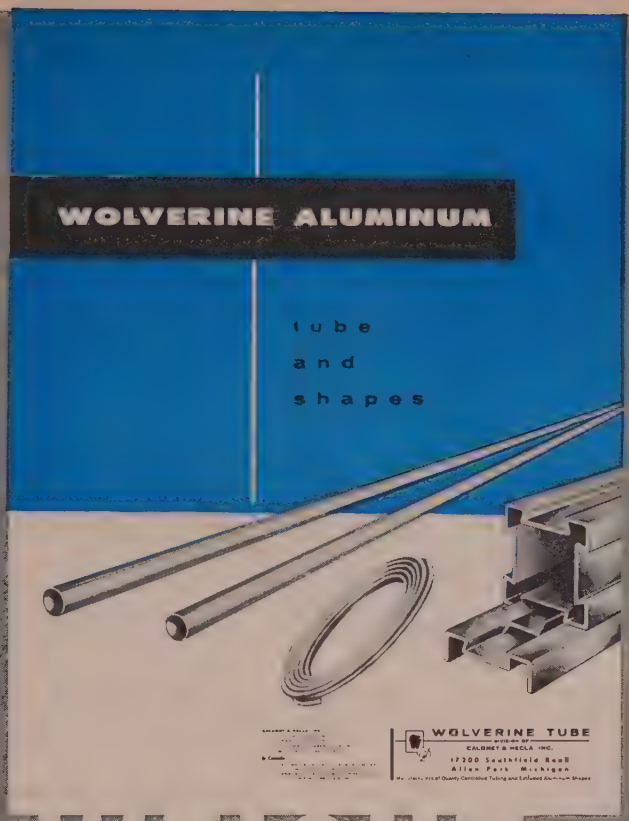
The only reliable way to determine the bending behavior of an alloy is to try it out under conditions approximating those of actual production. This is necessary because the mechanical test data supplied for various forms and conditions of aluminum alloys do not always reliably indicate the metal's bending properties.

Generally, however, an alloy having a proof stress near to its tensile strength, plus a comparatively low elongation, has less capacity for deformation than one having high elongation, and tensile strength much higher than proof stress. However, some heat treated alloys in certain tempers with double the elongation of some non-heat treatable alloys will work harden more rapidly during bending and cannot be bent as much.

Metal Ductility Important

The smaller the bend radius, or the larger the bend angle, the greater metal ductility required. Greater ductility is also necessary with an increase in length of bend or metal thickness (Fig. 1).

Sheet, especially when strip rolled, can be bent more severely across grain (Fig. 1) than along it. For most aluminum bending operations this factor is of little practical significance, though difficulties in bending with the grain can often be eliminated by bending across it. Test samples are invariably bent along the grain to subject them to the



WEIGHT WATCHERS SEND FOR THIS BOOK

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Manufacturers of Quality-Controlled Tubing
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EXPORT DEPT. 13 E. 40TH ST., NEW YORK 16, N.Y.

■ *Figure 2 shows samples of aluminum sheet bent flat, and having various degrees of "orangepeel" appearance due to grain growth. Picture was supplied by Aluminium Laboratories Ltd.*

least favorable bending condition.

Springback is a problem in bending aluminum just as it is with other metals. When a part is removed from the bending tool it rarely retains the contour to which it has been bent, but relaxes to a slightly smaller bend angle. This must be allowed for in designing the bend tool.

The exact amount of springback must be determined by trial. However, springback is greatest in aluminum alloys with a high proof stress and almost negligible in most annealed materials. Springback also decreases as metal thickness increases. One way to solve the problem is to bend the part to a larger bend angle than that finally required; in press bending, the punch may be bottomed into the die to set the metal, thereby reducing springback.

Bending is easier with the soft non-heat treatable materials than with harder alloys. If an alloy cannot be found to suit bending requirements, the bend radii must be altered.

Annealing Sometimes Needed

Sometimes annealing is necessary between bends. If so, before annealing, the metal should be cold worked as much as possible without cracking. Small amounts of cold work prior to annealing may lead to excessive grain growth in subsequent annealing. This results in loss of mechanical properties and "orangepeel" (Figure 2) in the surface when the metal is finally worked.

The heat treatable alloys were developed for strength and not for good bending characteristics. Greatest ductility is obtainable from alloys in the annealed condition. The solution treated condition generally allows a fair amount of bending, with the freshly treated metal giving best results. The fully heat treated condition permits bending only to generous radii.

Some solution treated alloys begin to age harden naturally at room temperature, reaching their full strength in 4 to 5 days. This means that bending should be done as soon as possible — within two hours after quenching for normal bending, or half an hour for severe bending. Age hardening can be delayed for 4 or 5 days by storing metal at low temperatures (21 to 14°F).

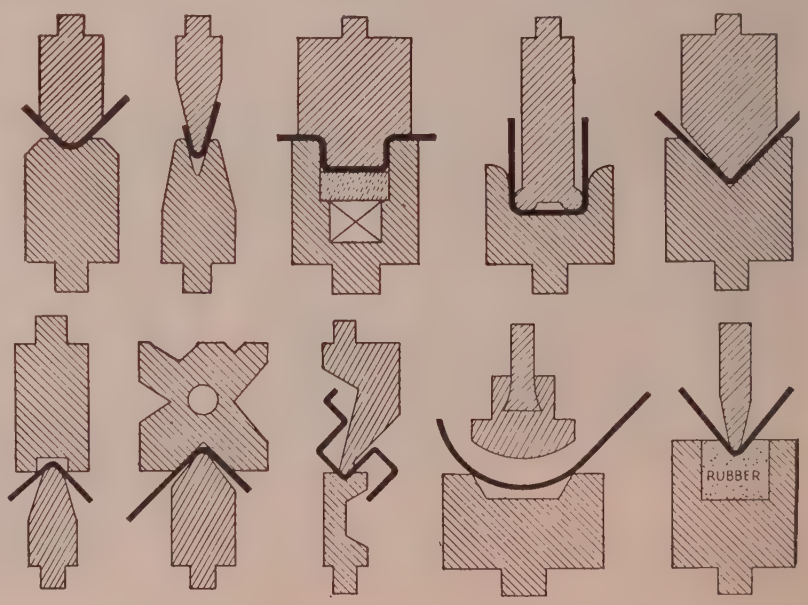
For most applications an alloy can be bent cold with no need for intermediate annealing. Hot bending of aluminum is unusual; its use is generally confined to the forming of sections for shipbuilding and aircraft applications.

For non-heat treatable alloys, hot bending, under controlled conditions, is usually limited to the aluminum-magnesium alloys. Local heating using a gas flame can be used. The flame should be applied gradually with a continuous stroking action so that heat will penetrate the metal's full depth. Otherwise, temperatures will be localized and mechanical properties lost. Use of electrically heated bending tools and thermocouples is recommended to keep close control on temperature.

Temperature Indicators

Hot forming temperatures are too low to produce any changes in the appearance of the metal, but simple methods of temperature control can be applied. Temperature indicators, such as pellets, crayons and paint can be used to determine approximate temperature, but care must be taken not to run the flame on or near the indicator.

Solution and fully heat treated alloys



■ *Figure 3. The single-action press brake is principally used to fold or bend long strips of sized sheet metal in simple shapes in one operation, or more complicated sections by multiple operations. Shown are typical sheet metal shapes formed and die sets used in press brakes. Lengths of 15 feet or more can be handled.*

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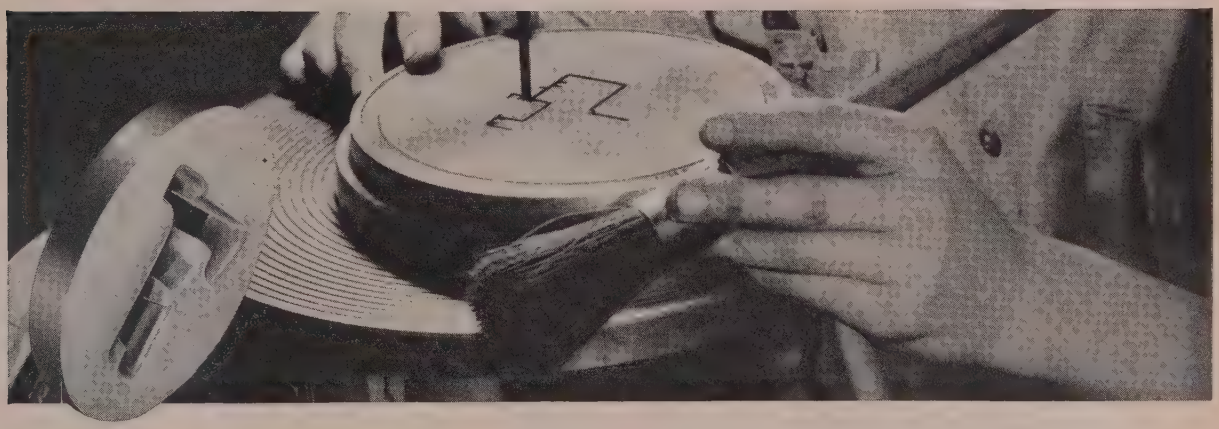
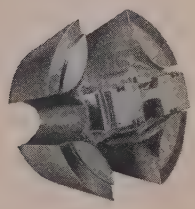
EXTRUSION DIES





It takes the right people behind the product to make a product of quality, and the extrusion dies manufactured by PMD are quality because behind their manufacture is the time-tested experience of specialists . . . PMD EXTRUSION ENGINEERS.

These specialists have not only the theoretical practice, but have on-the-job practical experience as well. They are skilled in every phase of extrusion dies, from design service to tooling function. From simple dies to the most complex dies. And remember, a PMD Extrusion Engineer is available to anyone having tooling problems. Call or write today.

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RADII FOR 90° COLD BEND IN ALUMINUM SHEET*

Alloy & Temper	Thickness (inches)	Bend* Radii
1100-O	.016-.250	0
1100-H14	.016-.128	0
	.129-.250	1T
1100-H16	.016-.182	0-2T
	.183-.250	3T
1100-H18	.016-.128	3T
	.129-.182	3T
	.183-.250	4T
3003-O	.016-.250	O
3003-H14	.016-.182	0-1T
	.183-.250	1½T
3003-H16	.016-.050	0-2T
	.051-.182	3T
	.183-.250	4T
3003-H18	.016-.050	½-2T
	.051-.064	3T
	.065-.128	4T
	.129-.182	5T
	.183-.250	6T
2024-O	.016-.032	0
	.033-.064	½T
	.065-.128	1T
	.129-.250	2T
2024-T3	.016-.032	4T
	.033-.064	5T
	.065-.250	7T
2024-T4	.016-.032	1½-5T
	.033-.064	6T
	.065-.250	7T
2014-O	.016-.125	0
	.126-.250	1T
2014-T3 & T4	.016-.032	1-3T
	.033-.064	4T
	.065-.125	5T
	.126-.250	6T
2014-T6	.016-.064	2-5T
	.065-.125	6T
	.126-.250	4-10T
5052-0	.016-.182	0
	.183-.250	1T
5052-H34	.016-.064	0-1T
	.065-.128	1½T
	.129-.182	2T
	.183-.250	3T
5052-H36	.016-.032	0-2T
	.033-.064	2½T
	.065-.125	3T
	.126-.250	4T
5052-H38	.016-.032	½-2T
	.033-.064	3T
	.065-.125	4T
	.126-.182	5T
	.183-.250	6T
6061-O	.016-.125	0-½T
	.126-.250	1T
6061-T4	.016-.032	1T
	.033-.064	1½T
	.065-.128	2T
	.129-.182	3T
	.183-.250	4T
6061-T6	.016-.032	0-1½T
	.033-.064	2T
	.065-.128	3T
	.129-.250	4T
7075-O	.016-.064	0-1T
7075-T6	.016-.032	5T

*T = Thickness of material.

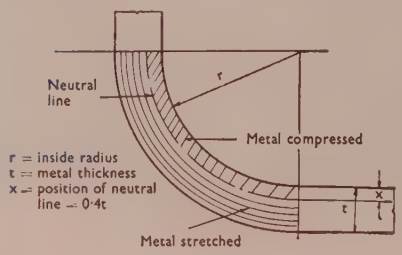
Many variables exist, such as the nature of the forming operation and the type and condition of the forming equipment, which affect the minimum radius over which sheet can be bent. Therefore, the minimum bend radius must be determined by trial and error, with this table acting only as a guide.

Compiled by Modern Metals from "Alcoa Aluminum Handbook," Aluminum Co. of America.

sometimes have to be heated for bending, but hot bending must be closely controlled. The metal can be annealed if necessary, corrected, solution-treated and then aged to develop its full mechanical properties.

Neutral Line

A bend has an imaginary curve, called the neutral line, which refers to that material which has not been altered in length. This curve separates metal which has been compressed, on the inside of the bend, and metal which has been put in tension, on the outside of the bend.



The precise position of the neutral line depends upon factors such as the properties of the metal, its cross sectional profile and the radius of the bend.

It is recommended that for alloys 2017-T4 and 1100-H14 (.080—.036 inch), where the inside radius of the bend lies between T and 4T (T being thickness), the average figure of x/T=.4 be used. This figure, accurate to within 20% of the thickness of the metal, should be used for calculating the length of aluminum and its alloys required for bends.

As a general rule no lubrication is needed for aluminum bent on ram or roll benders, due to the relatively large radii for which they are commonly used. Where severe stresses are encountered during bending, lubrication reduces friction at the sliding contact between the work and the tools. Scoring and screeching are a sure sign that a lubricant is needed.

For light bending a water soluble or light mineral oil can be used, but for heavy work a viscous oil or light grease is needed. The choice of lubricant for a job is often determined after many trials. An important factor is its ease of removal after the bend.

Bending Operations

Aluminum sheet can be bent with normal metalworking equipment. Special care is needed to ensure that working surfaces are smooth, polished, and free from rust, scale and particles of other metals which will mar the work.

A British bend test for sheet up to .104 inch thick is a measure of the ductility of the metal used. It requires that the "test piece shall not crack when bent through 180 degrees — either flat or around a former or radius up to five times the metal thickness, depending upon alloy or temper."

In cutting sheet before bending, it is important to produce edges free from burrs and other imperfections. This makes it mandatory that cutting edges of shears and guillotines be kept sharp. If necessary, sheet edges should be filed or ground smooth to further prevent edge cracking during bending.

If good surface finish is of prime importance it should be protected with heavy paper sheets, or with a proprietary lacquer which can be stripped off after bending.

In bending welded sheet, it is necessary in most cases to machine or grind the reinforcement off the weld. Here, care must be taken to remove metal particles and abrasives which might become imbedded in the surface of the joint during bending.

Grinding should be done at right angles to the axis of the bend to prevent failure of critical bends due to notch effect. Because of the soft zones around the weld and the cast structure of the weld itself, an irregular bend may result. This can be prevented by working the weld and the weld zone beforehand to modify its as-cast struc-

(*Continued on page 52*)

Temper Symbols for Heat-Treatable Alloys

F—as fabricated

O—annealed

W—solution heat treated—unstable temper

T—treated to produce stable tempers other than F, O or H (strain hardened)

*T2—annealed (cast products only)

T3—solution heat treated and then cold worked

T4—solution heat treated

T5—artificially aged only

T6—solution heat treated, then artificially aged

T7—solution heat treated, then stabilized

T8—solution heat treated, cold worked, then artificially aged

T9—solution heat treated, artificially aged, then cold worked

T10—artificially aged, then cold worked

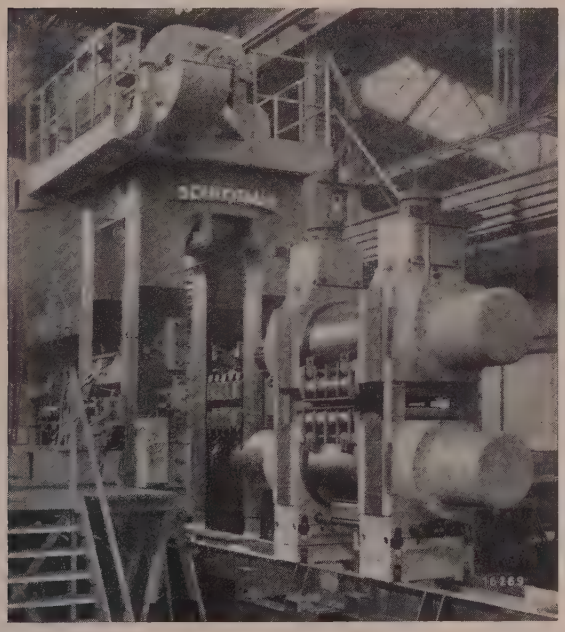
*The basic symbol T is followed by one or two digits (e.g. T6, T10). If variations of the same treatment result in different mechanical properties, the symbol is expanded by one or two additional digits (T61, T351), (from Aluminium Ltd. booklet "Aluminum Alloy Nomenclature.")

UDC 621.944.9

SCHLOEMANN
ROLLING MILLS HAMMERS PRESSES

Multi-purpose rolling mill for "refractory" materials

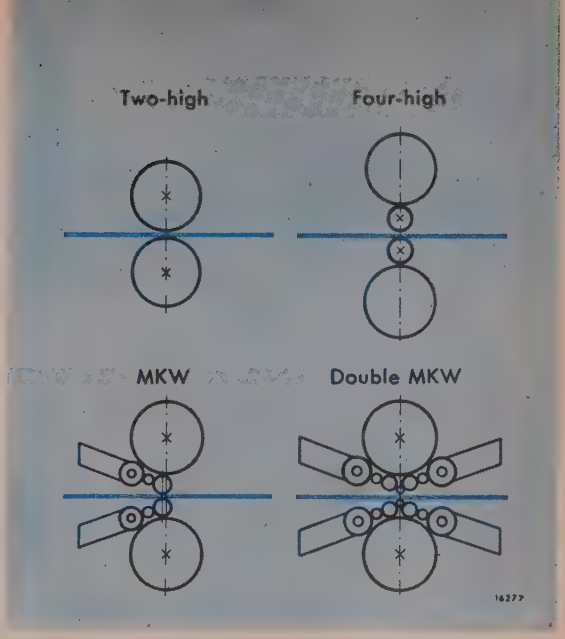
Special alloys for the nuclear power and other industries have presented extraordinary problems. The new MKW mill (US and foreign patents) developed by SCHLOEMANN is ideally suited for rolling these refractory materials and is readily adaptable



MKW 80 during workshop assembly. Above, the double MKW set-up is seen in run-out position; below, the view from the entry side shows the pay-off reel and coiler.

for conventional rolling work. Typical characteristics as included in the specifications of an MKW mill recently built for operation in the United States are as follows:

Hot and cold rolling – Initial thickness up to 2" Final thickness of strip – .006" standard; .001" min. Rolling force – in excess of 2200 tons at 24" strip width (twice the roll separating force required for rolling of conventional CrNi steels).



Four different roll set-ups for one mill:

Two-high set-up: 36" ∅ rolls

Four-high set-up: 16½" ∅ driven work rolls

MKW set-up: 36" ∅ driven back-up rolls, 5" to 5½" ∅ work rolls

Double MKW set-up: 36" ∅ driven back-up rolls, 2" to 2¼" ∅ work rolls

Wide working range

The mill is equipped with four different roll set-ups and is thus provided with an extremely wide working range. Since the new super high-grade but difficult-to-work materials are currently required in comparatively small quantities only, the use of one MKW mill with four different roll set-ups offers practical and economical advantages.

FELLER ENGINEERING COMPANY 1165 Empire Building, Pittsburgh 22, Pa.

12 Years and 22,000 Aircraft Later...

Amchem ALODINE* Continues Protection on Piper Aircraft

Another famed Piper model—the "APACHE"—flown by discriminating aircraft owners for business and pleasure the world over. If it's popular, it's a Piper!

to Insure Paint Bonding Aluminum Parts

Pioneering the commercial aircraft field since 1928, Piper Aircraft has compiled an amazing production record—*over 50,000 planes* produced during that time!

Amchem's Alodine record at Piper's Lockhaven, Pa. plant is equally amazing—since 1948, the aluminum parts on 22,000 Piper craft have been treated with Alodine for corrosion protection and outstanding paint bonding insurance!

Utilizing a straight-line, 7-stage dip Alodine tank system, Piper production experts turn out pre-paint protected aluminum parts ranging in size from ⅜-inch rivets to 10½-foot aft section skins. Piper officials, alert to the fact that aircraft are sold on looks as well as performance, back up the 12-year record of Alodine with quotes like these—

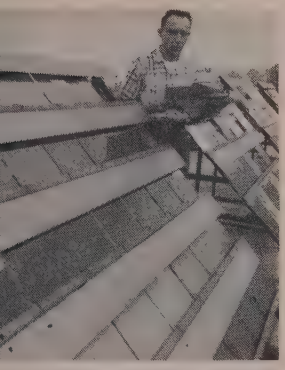
"My proof that we have a better finish is the fact that we don't have customer complaints from the field. We attribute it to the Alodine process which gives us the good paint bond we need." (Richard Gehret, Finishing Superintendent)

"Alodine is contributing to higher Piper quality, higher customer satisfaction, reduced complaints because the customer expects and gets a quality finish." (Findley Estlick, General Superintendent)

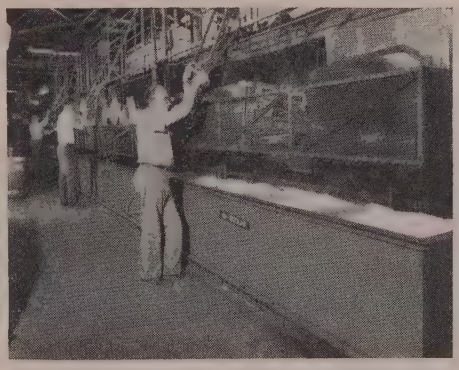
Piper uses over one million pounds of aluminum annually, fabricates ten to twelve thousand distinct and different aluminum parts . . . each and every one Alodized with Alodine to provide 1) unequaled corrosion protection, 2) excellent paint adhesion, 3) valuable ammunition that helps sell Piper's quality products the world over.

If you make any product with aluminum—there is a use for Alodine, the superior pre-paint conversion coating chemical!

*Amchem's registered trademark for its aluminum chemical conversion coating.



Al Sharp, Methods Engineer in finishing division, checks Piper exposure test racks where paint adhesion efficiency is carefully evaluated under severe environmental conditions.



Heart of the 7-stage dip Alodine system. Aluminum parts are stacked in rack-hung baskets suspended from monorail over the first three stages of the Alodine line.

The "grand old man of aviation," President W. T. Piper, poses on the flight line alongside one of the latest models bearing his name—the Piper "Aztec," last word in luxury flying.

AMCHEM **ALODINE**

Write for Booklet 1424C, contains detailed information on Alodine, plus handy Selection Chart.

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ture. Flux used in gas welding must be completely removed before bending.

Light gauges of aluminum sheet can be bent with a hand-operated bar folder designed for general sheet metal use. The sheet is gripped in the jaws of the machine and bent back on itself to the desired angle.

Single-Action Press

The press brake, or folding press, is a single-action press used to fold or bend strips of sized sheet metal. Its principal use is for forming long simple shapes in one operation, or more complicated sections by successive operations (Fig. 3).

Bending aluminum in a press brake requires a slightly different technique from that used for steel. Sheet must be controlled throughout the operation to prevent the formation of a radius (known as peaking) in advance of the male punch as it descends. Control is exerted in the tool design or by using a pressure pad.

If the radius of a bend is to be bigger than the specified minimum bend radius for the material, peaking is unimportant, but if it is to be the specified minimum or less, the additional springback produced may cause weakness at the bend as it opens out after being worked.

The lower the ductility of the metal, the greater the springback and amount of control needed. The problem is overcome by the use of spring-loaded or rubber pressure pads fitted to the die bottom to hold the material in close contact with the punch throughout the operation. Springback can also be overcome by using a punch shaped to an angle more acute than the die angle, so that the punch produces a definite set in the work at the bottom of the stroke. (See Fig. 4 for more preventives.)

Extremely wide sheets should be bent downwards so that the weight of the sheet assists the operation. (If it is bent upwards the weight of the sheet plus the lever-like action may create undesirable reverse bends.)

Clean Brake Tools

Press brake tools used for steel or other metals must be cleaned before use on aluminum, since swarf and metal particles picked up by the tools can damage the aluminum work.

The two basic types of tooling used on press brakes are air bending dies and bottoming dies. They are used for the most common press brake operation —the simple flange or 90 degree bend. The so-called "air bending" is done with angle bending dies in which the metal contacts the tools at three points only and is formed without striking the bottom of the die. When bottoming dies are used, the punch strikes solidly on the metal and die bottom.

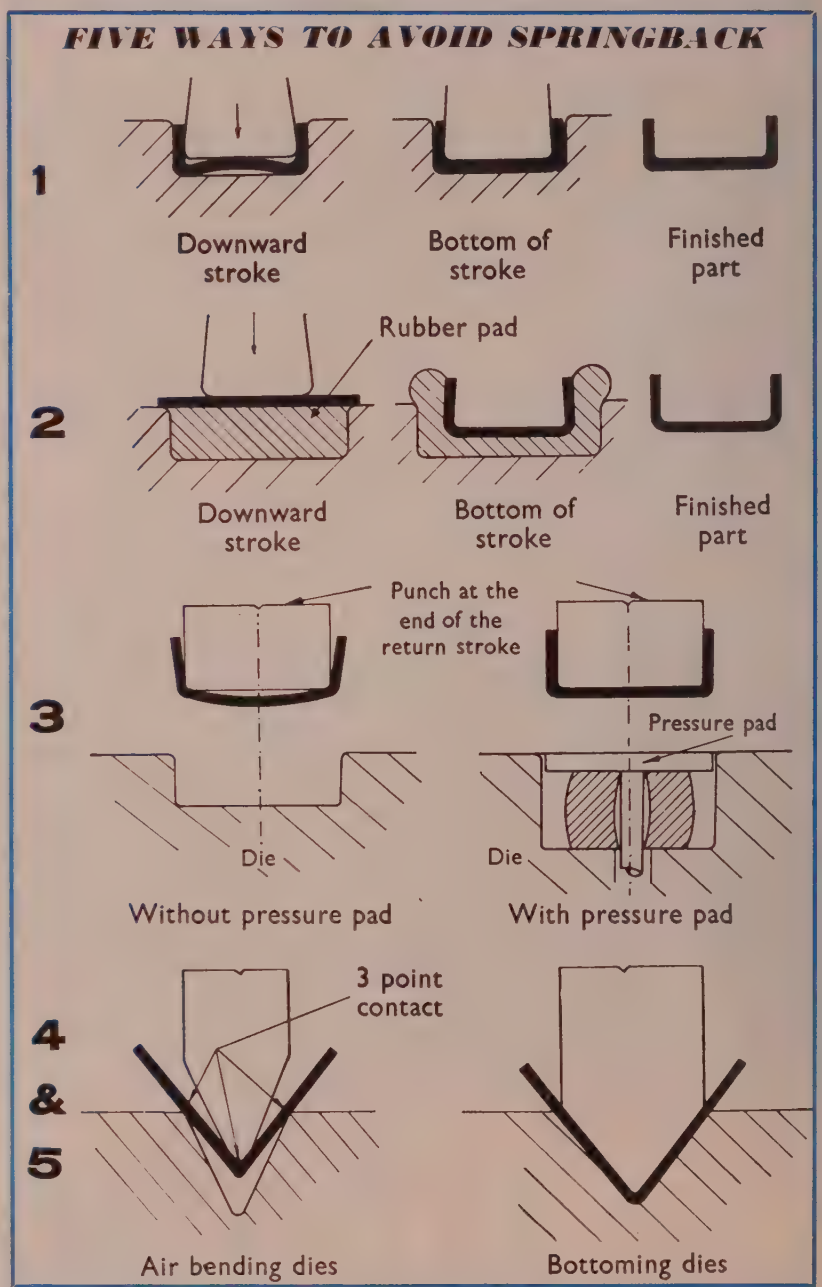
For practical purposes the bending pressure required for V-die bends can be calculated from the following:

$$P = K \times LUT^2 \div W$$

Here, P is bending pressure (tons); K is die-gap factor (varies from 1.2 for a die top width of 16T to 1.33 for a die top width of 8T; L is length of bend (inches); U is tensile strength of material (tons per sq. in.); T is metal thickness (inches); and W is top width of die (inches).

For channel and U shape bending without pressure pads, the pressure required is twice that for V bending. Where a pressure pad is used, the additional pressure in tons is .15 x pad area (inches^2).

The second part of this 2-part series will cover roll forming of sheet and strip, and bending of plate, bars, shapes and tubes.



■ *Figure 4 shows five ways to compensate for or eliminate springback. Springback can be compensated for by: 1.) Arching base of part, using tapered punch; 2.) Using rubber pad and tapered punch; 3.) Using pressure pad; 4.) Using smaller angle than required to permit overhang; 5.) Having close contact between punch, material and die. Final pressure sets metal to shape, and prevents springback.*

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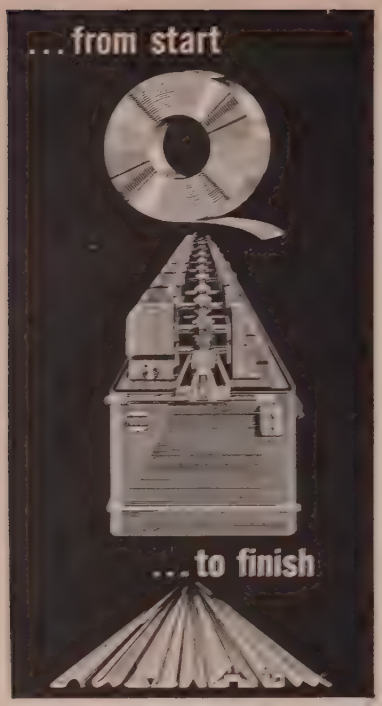

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Aluminum May Be Extracted From Coal Mine Waste by New Process

A NEW project now underway may well lead to a commercial process for the production of aluminum from domestic ores. The process is a joint venture of North American Coal Corp., Cleveland, and Strategic Materials Corp., Niagara Falls.

First step in the process is the production of aluminum sulfate. For this, North American plans to construct a $1 million extraction plant, with a 30,000-ton annual capacity, at its Powhatan Point, Ohio, mine. Initially, sulfate produced will be used to determine the commercial possibilities of producing aluminum oxide from coal mine wastes, bauxite, clay or high iron bauxite.

"In all probability many types of mine waste are suitable for this process," the company revealed. "The general requirements are for a moderate to high alumina content and relatively low alkaline impurities which act as acid consumers in the process."

Mine Waste—Sulfuric Acid

North American says the process starts with the reaction of mine waste material with sulfuric acid. This converts the aluminum and iron to soluble sulfates. Silica and other impurities remain inert and pass aluminum sulfate is recovered.

For the production of aluminum oxide, the aluminum sulfate is thermally decomposed to yield the metal oxide. The acid values are recycled in the process.

Work on the aluminum sulfate phase has been conducted on a pilot plant scale for several months and pilot plant investigation of the decomposition phase is in progress at Strategic Materials. It is expected that decomposition equipment will be installed with the commercial plant as soon as design data are obtained. This will permit production of low soda aluminum oxide suitable for making aluminum abrasives and ceramics, says North American.

Success of the process would offer a large source of raw material for the production of alumina. North American alone now produces over 500,000 tons of mine waste annually at its Ohio holdings. This contains an average of 2½% alumina (12,500 tons), or 20,000 tons of metal.

Output of coal and aluminum-bearing mine waste is expected to double because of expected power developments in the area.

There are 10 million tons of the mine waste above ground and an estimated 200 million tons underground.

Because of the location (on the Ohio River), and the extensive reserves, North American sees the possibility of a completely integrated aluminum production industry at Powhatan. The firm says equally interesting possibilities could exist in other low cost power areas with clay being used as the raw material.

Why A Coal Company?

Why is a coal company interested in developing this process? "Because," says North American, "if mine wastes can be converted to a raw material for the aluminum industry we can expect an increase in the amount of coal required to generate power, without the accompanying problem of disposing of mine waste."

The firm says it takes 8 tons of coal to generate enough power to produce 1 ton of aluminum. And it adds that the problem of waste disposal is becoming increasingly serious.

But there could be another reason. North American may be grooming itself for a role as a primary producer of aluminum. R. L. Savage, vice president of research, admits that his firm is carefully considering this possibility but he would make no additional comment.

Henry G. Schmidt, president of North American, says: "Production of aluminum ore could overshadow our present activities many times and we may even become a primary aluminum producer."

This is a very optimistic statement considering the fact that North American is the eighth largest non-captive coal company in the country.

The firm has not divulged any specific cost data, but has said that its process can produce aluminum sulfate at a cost considerably less than the current $50-a-ton price tag on imported bauxite.

Other Research

Other work of this type has been conducted in the past. In early 1959, the Canadian Department of Mines and Technical Surveys published a report on its efforts to recover cell grade alumina from aluminiferous clays and shales.

John Convey, director of the department, confidently states that "it seems certain that cell alumina can be prepared with our procedure." However, he adds that so far his group's work has not attracted any industrial attention. Work has only been done in laboratory experiments, and a pilot plant operation would be necessary before a commercial installation could be considered.

The Choice is Wide, The Value is High with Hevi-Duty Furnaces

Here are three users of melting and holding furnaces. They represent three methods of casting, using either fuel-firing or electric resistance heating, yet each has found the answer to his needs at Hevi-Duty. This is not surprising.

Hevi-Duty now offers the widest choice of heat processing furnaces — both electric and fuel — in the industry. This is important in terms of furnace value. It means you can probably find a proven unit that fits your needs exactly.

Why not consult a Hevi-Duty Sales Engineer soon? Let him show you why a wide choice means a high value in furnace equipment.

HEVI-DUTY

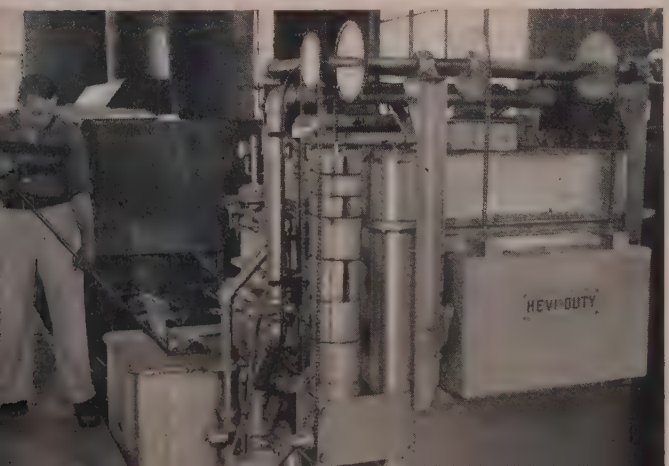
Electric and Fuel-Fired Industrial Furnaces and Ovens

B P C — A Division of Basic Products Corporation

Hevi-Duty Electric Company, Milwaukee 1, Wis.

This electric crucible furnace is used by Baso, Inc., Milwaukee, Wisconsin, for holding aluminum at 1240°F. Baso casts components for controls for all types of gas burning equipment from permanent molds. Circular design allows three dip-out stations. There are no exhaust fumes, no bath turbulence, and exterior shell remains relatively cool. ***For complete information on this furnace, write for Bulletin 591.***

Elm City Pattern and Foundry Works, Branford, Conn., uses this dry hearth furnace for sand casting aluminum. Mr. Hal Burkehard, Foundry Manager, likes the way the thermocouple control holds the bath at uniform temperature. He reports that this unit produces cleaner castings than do their other furnaces . . . that he gets only a handful of dross from a 500-lb melt. ***Please request our Bulletin 594.***



A gas-fired, double chamber dry hearth furnace is used for die-casting electric frying pans at the New England Die-Casting Company, West Haven, Conn. Aluminum melts on a sloping hearth and runs into a dip-out chamber where it remains at constant casting temperature. Moisture and volatiles escape during heating. Foreign materials remain on the hearth. This assures clean, high-quality metal on a production line basis. ***Please write today for Bulletin 594.***

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Installing a Captive Anodizing Plant

Economy — greater efficiency — improved customer service. These and other important factors usually cause a large manufacturer to install his own anodizing equipment. And while private lines are becoming more common, the demand grows for anodizing of bigger products.

By Gilbert Tramer and Jack Lashkow

IT ISN'T to be doubted that the job anodizer is here to stay. The service he renders the medium-sized to small fabricator (even the larger ones, in many instances) is invaluable.

But often enough the small fabricator grows to the point where a captive anodizing plant becomes a necessity. Basically, the factors dictating such a move are always the same: More efficient operations; greater economies; improved customer service.

Recently, when we installed large batch anodizing tanks at the Weathertite Co. of Bedford, Ohio, we had these considerations spelled out for us.

"The decision to proceed with our anodizing plant was made upon realizing that there is an ever-increasing demand for anodized products and our volume was so great we were unable to find enough suppliers to handle this volume," said Ralph D. Lomaz, vice president of Weathertite.

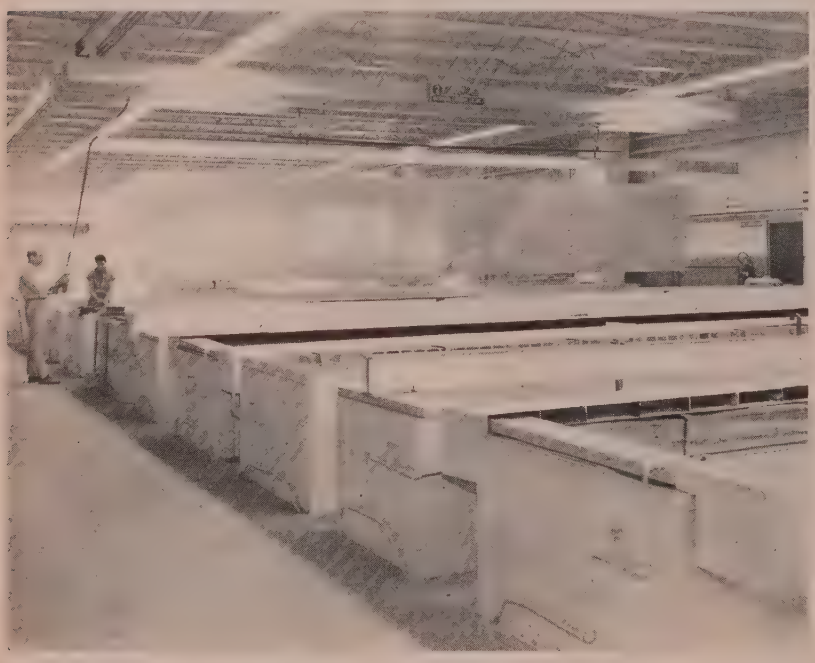
He also mentioned reduced spoilage by eliminating shipment and handling to and from the contract shop, improved quality control granted by the captive operation, and the ability to give the work a heavier anodized coating.

"The greatest advantage in having our own facilities is that we can do a superior anodizing job," Lomaz said. "These new facilities have also made it possible for us to introduce color anodizing to the industry."

The past few years have brought a trend to larger anodizing tanks to accommodate the bigger aluminum fabricated parts produced today, as well as the increasing business volume of aluminum fabricators. Other benefits of larger tanks are their more uniform temperatures, their less noticeable drag-out, and the fact that small amounts of impurities do not alter the chemical balance as quickly.

Since greater quantities of work can be processed at one time, there is more part-to-part uniformity. And since batch type installations are usually run by one or two men the load per lift can be increased, thus boosting production without increasing the work force.

The installation at Weathertite, which anodizes the company's line of aluminum windows and doors, consists of tanks measuring 37 feet long and 6 feet deep. The system has two tanks for anodizing, three for dyeing, and two for seal, as well as tanks for precleaning, etching and desmutting.



■ *Concrete tanks in Weathertite's new anodizing installation are 37 feet long. Each tank has its own air agitating unit (except seal and desmut tanks). This is one of the largest captive anodizing installations in the U. S.*

Cycle for Color Work

The cycle of treatment for etch and color work is as follows:

1. Proprietary non-etch cleaner at 150° for 2 minutes.
2. Rinse at room temperature for approximately 1 minute.
3. Alkali etch at 140° for 2-5 minutes.
4. Rinse at room temperature.
5. Desmut at room temperature for 15-60 seconds.
6. Rinse at room temperature for 1 minute.
7. Sulphuric acid anodize 72°, minimum of 20 minutes.
8. Rinse at room temperature for 1 minute.
9. Rinse at room temperature for 1 minute.

(*Continued on page 60*)

another development of DIVERSEY research . . .

DIVERSEY 17

NEW NON-SILICATED INHIBITED ALUMINUM CLEANER

An entirely new type of inhibited aluminum alkaline cleaner that eliminates silicate film and etching problems! When cleaned in Diversey 17, buffed work or extrusions to be etched are ready immediately for further processing. There is no need for acid baths to remove silicate film normally produced by conventional silicated cleaners. Formulated specifically for soak cleaning of aluminum, Diversey 17 also produces excellent results on steel, zinc, die cast and other metals. Used as recommended, it will not etch anodized aluminum.

Safe to handle—contains no free caustic

For the full story on how Diversey 17 is increasing production and cutting rejects, talk to your Diversey D-Man. He's the best consultant you can find on metal surface preparation. Or write Metal Industries Department, The Diversey Corporation, 1820 West Roscoe Street, Chicago 13, Illinois.

DIVERSEY® DIVERSEY 17 NON-SILICATED CLEANER®

10. Dye (temperature and time depend on dye used).

11. Rinse for 1 minute at room temperature.

12. Nickel acetate seal at 200-212°.

13. Hot rinse for 1 minute.

For clear anodizing, the cycle is the same up to step 9, after which the work is placed in the hot seal, then rinsed for 5-10 minutes.

Cast Concrete Tanks

All the tanks are concrete and were cast as complete units with the floors, walks and drains of the entire system.

The alkali and etch tanks are lined with 3/16-inch steel plate and the heating coils are steel. The rinse tanks are coated with epoxy paint, and the rinse overflow is constructed of stainless steel stand pipes. The desmut tank is lined with acid resistant brick, grouted with a lining that is impervious to nitric and oxidizing acids.

The anodizing tanks are lined with acid resistant brick, while the dye and seal tanks are lined with 12 gauge type 316 stainless steel. The coils for these tanks are also type 316, schedule No. 40 pipe. All the coils are of parallel header construction in order to minimize resistance to heating.

Each tank has its own air agitating unit with the exception of the seal and the desmut tanks. Air supplied by two 5-hp compressors is filtered to remove oil prior to entering the tanks. The agitation systems in the anodizing tanks are PVC pipe. In the dye tanks, stainless pipe is used; in the etch and cleaner tank, steel pipe is used.

The d-c power to the anodizing tank is supplied by a 7,500, 24-volt Columbia motor generator set. The control for this unit was mounted close to the anodizing tank in order to be accessible to the operator at all times when the work is in the tank. Copper busbar to the anodizing tank is silver plated at all the joints.

The compact chiller for the anodizing tank has a rating of 60 tons. The anodizing solution is pumped through a heat exchanger constructed of Karbate tubes in a steel shell. The chilled water is recycled through the steel shell. The anodizing pump is rubber lined throughout.

The anodizing solution is continuously cycled through the cooling system, and the operation of the chiller is controlled by a reverse acting temperature controller placed in the sulphuric acid line. All piping carrying the anodizing solution is PVC.

Double-Duty Acid Pump

The rubber-lined acid pump not only circulates the solution through the exchanger, but also circulates the anodizing solution in the tank. This system enables the company to maintain the temperature in the anodizing tank to within one half of one degree. Since the cooling mechanism is entirely outside the tank, no shorts are caused by the work coming in contact with cooling equipment.

A surge tank is provided for the cooling water before it is pumped into the cooling exchanger. All piping for the cold water is copper.

The spent water from the condenser is piped through the rinse tanks and is used as makeup water for the rinses. The water is admitted into the tanks through a water agitating pipe extending the entire length. This also helps to agitate the rinse tanks.

The gas fired hot water boiler has a rating of 200-hp to heat water to 300° at 150-pound pressure. A pump with a mechanical type seal circulates the hot water through the coils. A standby pump was installed in the event the operating pump fails.

Each tank has its own temperature control for maintaining the solution to within plus or minus one-half one degree.

The overhead transfer crane is mounted on two monorails. Each hoist is individually controlled to raise or lower the work to permit complete drainage before transfer from one tank to another. The horizontal movement of the hoist is also electrically powered. Hoisting speed is approximately 40 fpm. Horizontal movement is about 125 fpm.

The exhaust system for the etch, precleaner and seal tank is constructed of steel. The tube axial exhaust fan is installed directly in the riser. Each tank has its own exhaust fan, driven by its own 15 hp motor. The sulphuric acid tank is exhausted by a system constructed of glass-reinforced polyester. The fan is solid PVC.

To Replenish Air . . .

Since each system exhausts approximately 25,000 cfm, it was necessary to provide make-up air for the room by putting louvers in one of the walls. Air entering the building passes through the louvers and then through automatically controlled radiators.

The anode carrier bars are constructed of two aluminum channels bolted back-to-back. The racks are bolted in between the two channels, thereby assuring absolute contact to the carrier bar and the rack.

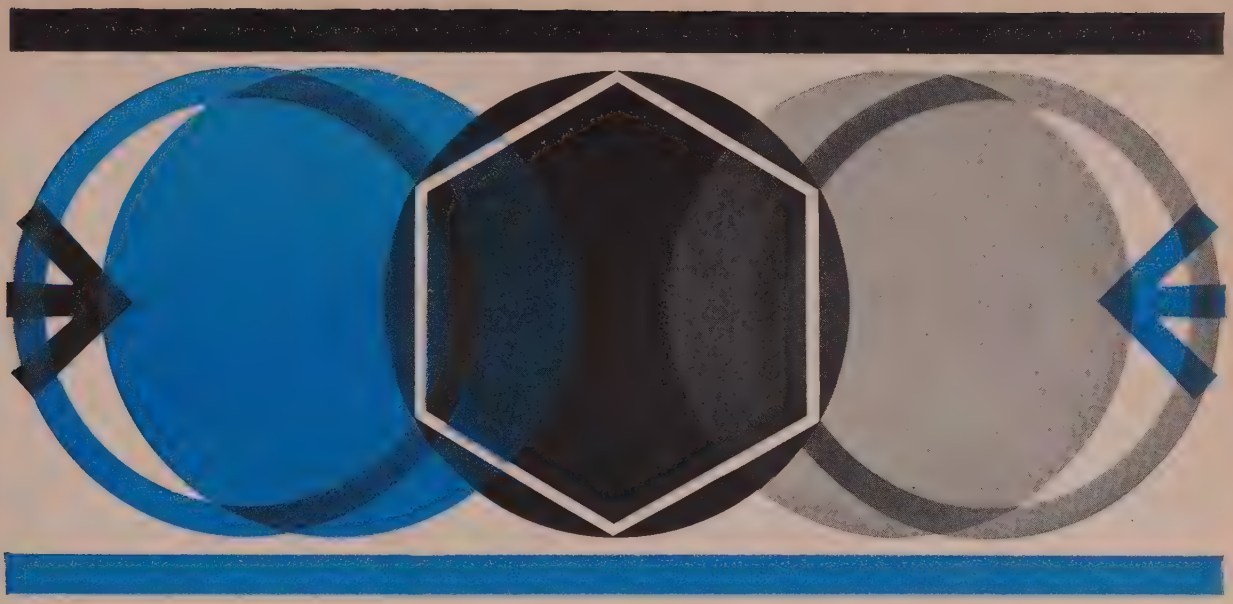
A 5000-gallon tank for sulphuric acid was installed. The acid is first run into the anodizing tank.

All the waste and rinse waters are piped into a 5000-gallon concrete tank lined with sheet PVC. From this tank the water runs into a common pipe with the rinse waters at a very slow rate and then empties into a nearby creek.

The entire system is operated by one crane man and two to three rackers and unrackers. The time of dwell in the processing tanks is controlled automatically.

The secret of the success of this inexpensive system is to keep enough racked work ahead of the processing operator. A space of 50 feet ahead of the processing tanks is maintained for this purpose.

■ *The size of shapes being anodized in batch systems has been growing steadily, but the larger tanks required actually bring operating benefits. Shown is a racking operation at Weathertite Co.*



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Reason 3. Blooms are scalped to remove all surface irregularities and defects.

Reason 4. All blooms are cleaned, etched, inspected and coated with a special lubricant.

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Why not find out for yourself? Ask your local Olin Aluminum sales office or distributor for the names of firms in your area who have discovered cold processed rod and bar. Hear what **they** have to say. **Write for our brochure on Cold Processed Rod and Bar.**

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Continuous Flash Annealing Produces Fine Grained Aluminum Sheet

New induction heating process imparts uniformly fine grain in coiled sheet up to 48 inches wide regardless of size of coil. Plans are now underway to build a flash annealer to handle stock up to 80 inches wide.

by Robert V. Lackner, Penn Induction Corp., Pittsburgh 26, Pa.

WHEN large coils of aluminum or brass sheet are annealed in conventional ovens, the problem of grain growth can become severe. Metal in the outer layers of the coil remain at peak temperatures for prolonged periods while the heat slowly seeps into the center of the coil.

The result, too often, can be a coil of sheet possessing non-uniform fabricating characteristics. Sheet from the center of the coil may have an acceptable grain structure for stamping, drawing and bending operations while that from the outer layers will have coarse grains resulting from its too-long exposure to annealing temperature. Coarse grain often gives rise to cracks or tears during fabricating operations.

Flux Induction Does It

A new continuous flash annealing process that by-passes this problem has been developed jointly by Penn Induction Corp. and Pennsylvania Electric Coil Corp. The process applies heat to the material by the transverse flux induction method in which the flux lines are vertical to the material being heated. The rapidly alternating electric current *induces* the material to heat itself.

Since the metal is exposed to heat for a brief period of time, grain growth is virtually nil. Grain size is often one-third to one-fifth that of similar material annealed in conventional furnaces.

It has been known for some time that flash annealing will produce the fine grain structure desired for fabricating operations. The trick has been to find an efficient means of applying heat uniformly throughout the material.

For highly reflective metals such as aluminum, brass and stainless steel, radiant heat is not efficient. Too much radiant energy bounces off the shiny surface instead of being absorbed. Earlier attempts to use transverse flux induction heating proved unsatisfactory owing to the inability to achieve uniform distribution of heat across a wide sheet of metal.

Our problem was to devise a means of inducing currents in a moving strip of metal in such a manner that the full width of the sheet would receive the same current density. We solved the problem by creating a new arrangement of the induction coils that induce heat in the material to be annealed.

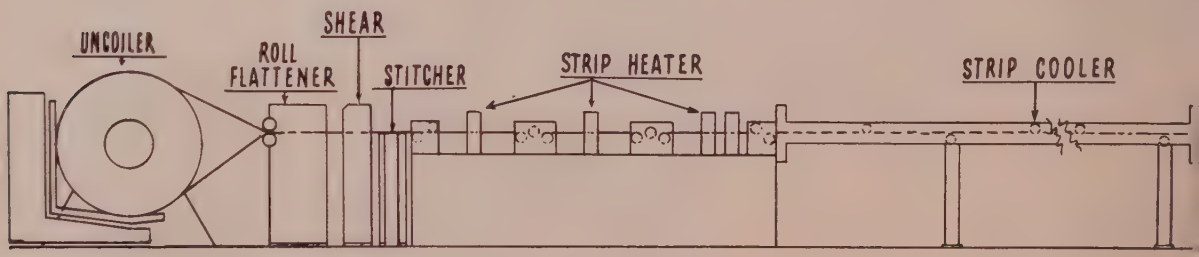
Consider a simple arrangement of two induction coils placed above and below a moving strip of metal as shown in Fig. 1. The coils are excited by an alternating current source which creates flux lines indicated by the arrows. The resulting currents induced in the strip are approximately the shape of the coils as indicated in Fig. 2.

The concentration of current in the slot areas creates a high current density in those areas, but a much reduced density at the slot ends. Obviously, our two narrow heat zones are not producing anything approaching uniformity. Only a small portion of the sheet receives the annealing heat.

But when we revolve the two coils on an axis in the direction of the flux lines as shown in Fig. 3, the heating pattern is spread out to cover a much wider area of the moving strip of metal. We reduce the length of the current path with respect to the direction of strip travel, but the two concentrated heat patterns are now overlapped so that all of the sheet in the section between "x" and "y" (in Fig. 3) is subjected to the same current density as it passes between the coils.

When we mount a multiplicity of coils in this manner (see Fig. 4) and position them properly with respect to the direction of strip travel, a uniform temperature is induced across the full width of the strip to be annealed.

SCHEMATIC DRAWING OF A CONTINUOUS LINE FOR



ELECTRICAL EQUIPMENT

Motor-Generator—350 KW; 500 H.P. 960 cycle
Motor Starter—500 H.P.; 440 V; 60 cycle
Generator Control—350 KW; 400 V; 960 cycle

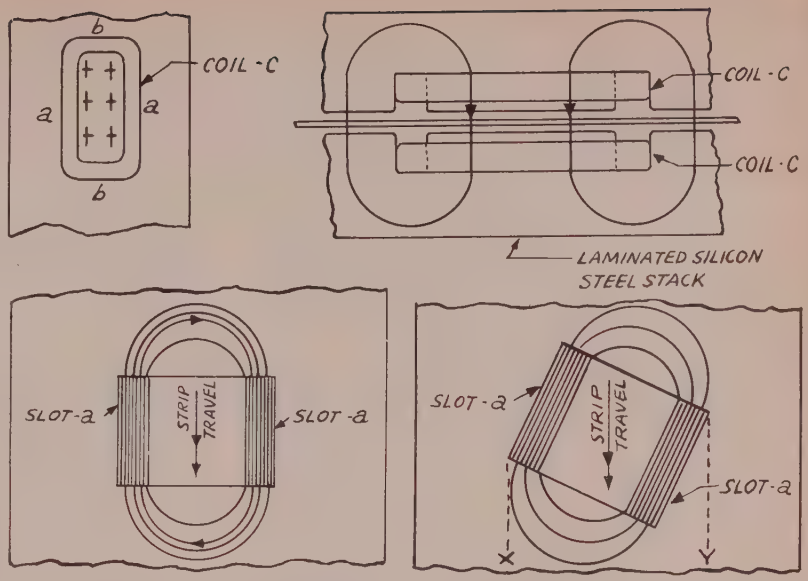
NOTE: Roller leveller may be installed as shown if needed for levelli

A clearer idea of the heating effect thus achieved may be gained from Fig. 5, showing an elevation view of several coils plus the strip metal between them. Flux lines are indicated by the arrows.

All coils, with respect to the air gap through which the strip passes, are of the same polarity for the instantaneous flux direction shown. Each slot containing a coil side is covered with a carbon block so that no marking will occur if the strip vibrates in the heater.

All coils are duplicates, have the same impedance, and are connected in parallel across a common source of voltage. Thus, the unit is self-correcting with respect to temperature uniformity across the width of the strip. Reason: The load impedance to each coil will be the same only if the temperature of the metal under each coil is the same.

For example, if the metal under Coil 2 is hotter than that under Coil 4, the impedance of Coil 2 is higher than that of Coil 4. Thus, the current in Coil 2 decreases, as does the KW input, which automatically decreases the temperature of the metal under Coil 2.



■ ***Fig. 1 (top right) shows two induction coils above and below moving strip. Alternating current in coils creates flux lines (arrows). Fig. 2 (lower left) shows shape of currents in strip. By turning coils in direction of flux lines (Fig. 3, lower right) heating pattern spreads out to cover wide area of strip.***

Small Annealed Grain

In annealing aluminum alloy 5052 strip (36-inches wide by .032-inch thick), we achieved a typical grain structure of 2150 grains per sq. mm. Tensile strength was 29,000 psi, and elongation was 24% in 2 inches. On 3003 alloy strip (18 inches wide by .018-inch thick), typical results were 2060 grains per sq. mm.; 17,200 psi tensile strength, and 28% elongation in 2 inches.

In developing this equipment, we experimented with various frequencies of alternating current. First experiments employed 60, 180, and 400 cycle current. Later, higher standard frequencies of 960, 3000, and 9600 cycles were tried.

With 60 cycle current and .032-inch aluminum as the load, a violent vibration occurred as a result of the motor action caused by the currents in the strip and the coils. The metal was so light and the frequency so low that the strip followed the 60 cycle reversals.

Although the temper and grain structure of the strip was metallurgically acceptable, the extremely loud vibrations would constitute a plant hazard. Vibration was greatly reduced by boosting the frequency to 180 cycles, but the noise was still objectionable.

At 400 cycles — still using aluminum — no visible vibration was discernible, and audible vibration had decreased to below the noise level of the generator, which was operating at 1700 rpm.

Further tests indicated that for most aluminum alloys 9600 cycle equipment is best for thicknesses of .0035-inch and up; 3000 cycles for .002-inch and up; and 960 cycles for .006-inch and up.

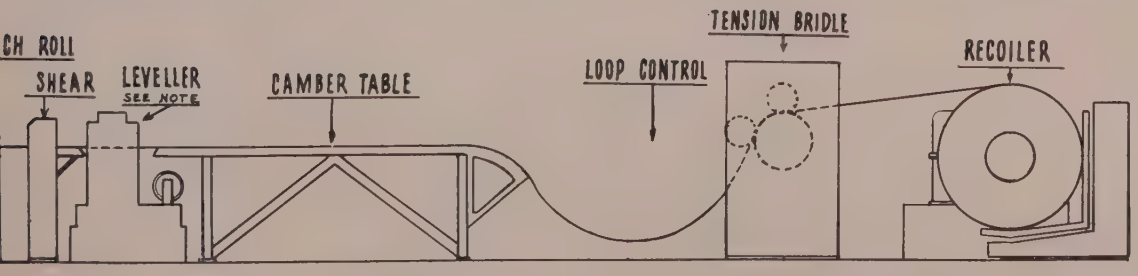
An examination of capital costs showed the 960 cycle equipment to cost less initially than 400 cycle equipment. In either case the same basic apparatus is used. This includes a motor generator set, motor starter, generator control and a bank of capacitors.

Initial costs for 3000 cycle equipment are about the same as 400 cycle, but for 9600 cycle the cost is approximately 5% more than for the same capacity 400 cycle equipment. Other savings result from the use of the higher frequencies. For example, installation costs are lower since higher standard frequency sets do not normally require foundations. Furthermore, all components are stock items for higher frequencies but special for the 400 cycle equipment.

Metallurgically and physically the same characteristics were produced by heating aluminum with 3000 cycle as with 400 cycle equipment. But 3000 cycle units maintained a higher efficiency for light gauge metal.

For heating brass, steel and other metals on a continuous basis the selec-

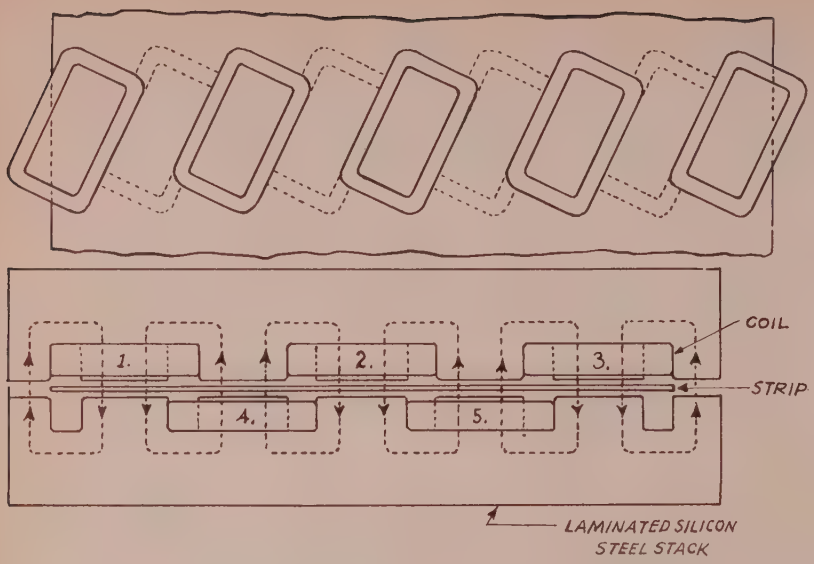
...ASH ANNEALING 48-INCH WIDE ALUMINUM STRIP



LINE DATA

Material—aluminum alloys
Strip Gauge—.008-.090-inch.
Strip Width—48-inch max.
Coil Weight—4000-lb. max.
Coil Size—60-inch O.D. max; 20-inch I.D.
Line Speed—10 to 100 fpm.

soft metal. When metal is to be temper rolled, leveller is not required.



■ *Fig. 4 (top). By positioning several coils in relation to strip travel, uniform temperature is induced across full width of strip. Fig. 5 (lower) is elevation view of several coils with strip metal between them. Arrows show flux lines.*

tion of frequency is a matter of engineering design. Cost of equipment varies slightly with frequency between 960 cycles and 9600 cycles. Performance is best if frequency is selected on the basis of minimum gauge to be heated. In most cases this will give uniformly high efficiency over the range of gauges to be heated in any one heater.

12.5 Pounds Per KWH

Heater economy has been checked with aluminum and brass loads. For aluminum it was found to be 12½ pounds per KWH to annealing temperatures. Studies for brass included systems for preheating as well as for full anneal. For preheating to 850°F on 70/30 brass we reached 24 pounds per KWH. For full anneal at 1400°F we have reached an economy of 17 pounds per KWH.

The present design of the heater core and coil stack was decided upon after many changes. The laminated silicon steel stack is 7 inches long in the direction of strip travel. Each heater has an overall length of 18 inches including coil overhang and mounting frame for busses and water headers (see Fig. 6).

This design permits use of several heaters arranged in tandem with supporting rolls in between.

Supporting rolls are normally carbon-covered to minimize pick-up and marking. Where no rolls are permitted to touch the strip, heaters can be arranged vertically with the strip passing down through them into a cooling or quench zone before recoiling.

We have found that, with aluminum, a temperature rise of 300°F through each heater gives the best results and minimizes deformation due to thermal shock. Thus, a minimum of three heaters should be used for aluminum (see diagram) and five for brass. Including supporting rolls, heater length is approximately 8 feet for an aluminum annealing line processing strip at a rate of up to 100 feet per minute.

So far we have discussed the heating of aluminum and brass alloys above their recrystallization temperatures and following this with air or water quench before recoiling. In the case of heat-treatable aluminum alloys, where the metal is held at above recrystallization, the flash heater is followed by a holding zone before quenching and coiling.

This yields a grain size about one-half that possible when preheating and holding are done in conventional high speed convection units. This is possible since induction preheating time is approximately 4% of the total heating cycle as compared to about 20% in the case of convection heating.

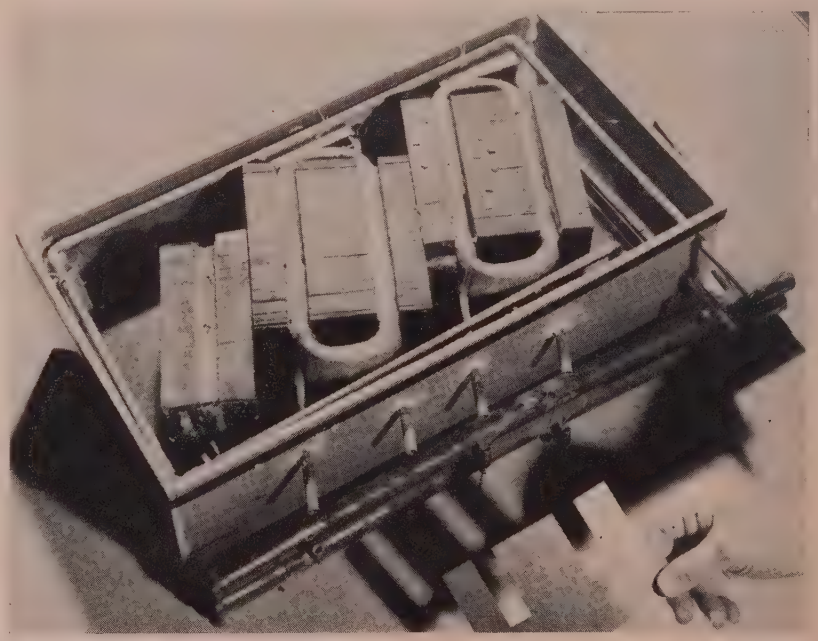
The fine grain size produced by the new annealing process is important, but the induction heater has many other advantages. It removes rolling oils without oil staining; it eliminates orange peel effect; it prevents magnesium precipitation in aluminum alloys, and lead precipitation in brass alloys; and it offers the possibility of annealing to temper from full hard without subsequent temper rolling.

In addition to annealing and heat treating nonferrous metals, many other applications for the process are being investigated. Future uses might include drying vinyl coatings on metal strip; laminating foil in the packaging industry; intermediate annealing of slabs; and annealing of silicon steel strip.

The equipment can also become part of extended continuous cycles. One producer sees savings by combining a slitting line with flash annealing.

Bigger Annealers Coming

The flash induction heater is already being commercially produced. The largest model (see drawing, pages 62-63) can handle metal strip up to 48 inches wide and aluminum and brass alloys in thicknesses from 0.00035 to ½ inch. Plans are already under way for an induction heater which will flash anneal strip metal up to 80 inches wide.



■ *Fig. 6. Bottom section of continuous heating unit, showing water cooled coils mounted on stacks of silicon steel laminations supplied by Allegheny Ludlum Steel Corp., Pittsburgh. A single lamination is being held in front of unit.*

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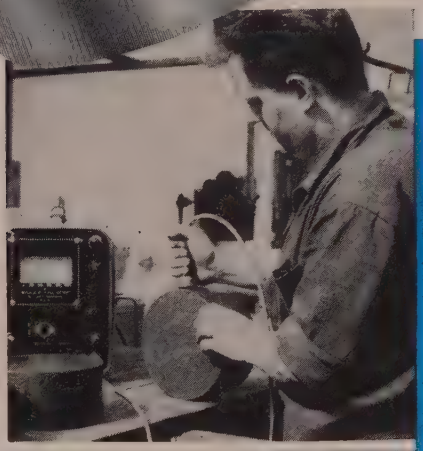
TOOL STEEL



Every single disc is tested ultrasonically in two dimensions for defects. This technician is probing the periphery of a forged disc with ultrasonic equipment.

Here the disc is being tested on magnaflux equipment to find defects near the surface.

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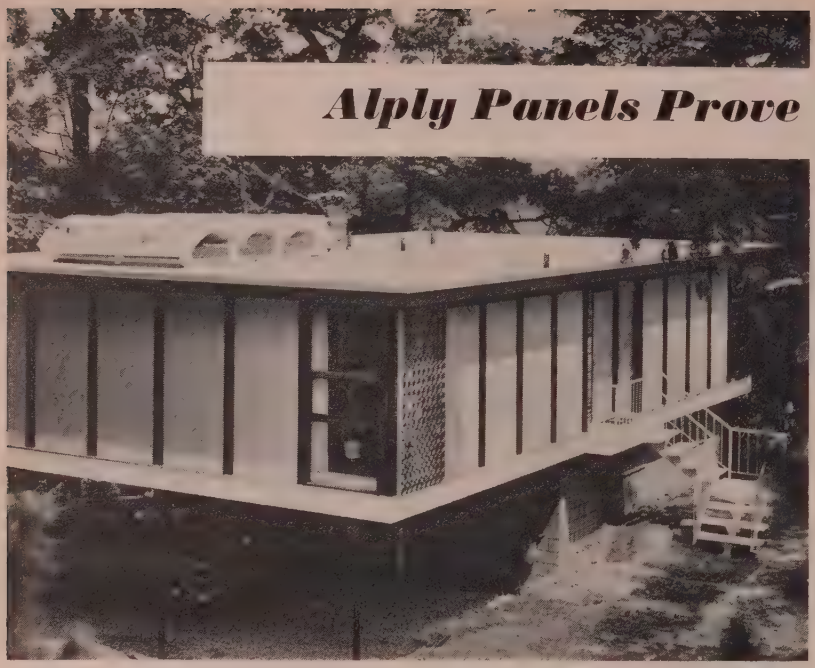


Alply Panels Prove Cost-Competitive

In Home Building

Alcoa's plastic-aluminum building material was used to enclose outside walls and serve as a roof deck in a private dwelling built near Pittsburgh. Builder says home could be repeated in quantity and at less cost. Volume production has reduced cost of this versatile panel material.

MODERN sandwich panels were combined with the age-old post and beam structural method to build an attractive 1700-square foot private home near Pittsburgh. Erected at a cost competitive with that of standard construction methods, the dwelling was designed to be repeated easily and on a volume basis.

The new twist in this contemporary home, designed for his own occupancy by architectural engineer Paul Freeman, is the use of Alcoa Alply panels for exterior walls and roof deck. Alply is basically a new structural material consisting of foamed plastic sandwiched between aluminum sheets or other facing.

As such, the panel itself incorporates exterior siding, insulation, and interior wall surface. Thus, it can eliminate such costly field operations as sheathing, plastering, painting, applying siding, and even interior decorating. The material is even strong enough to serve as the principal load bearing member in many building applications, in which event it would also eliminate conventional framing.

In the Freeman house, however, the framework is of the post and beam type, roughly similar to that employed over 2000 years ago in ancient Greece. The house was constructed by Thomas Douglas, a custom builder who produces about 10 houses annually.

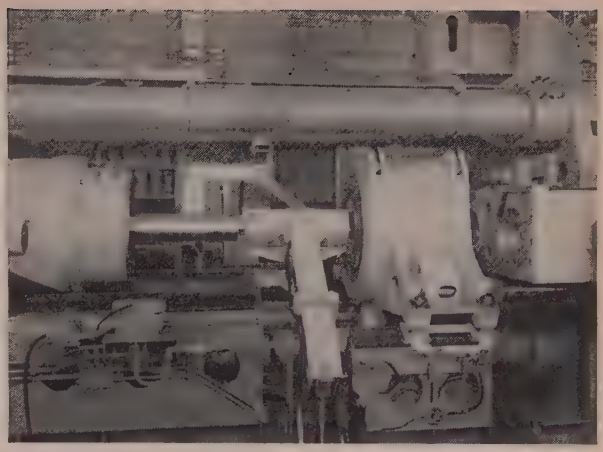
"Building with Alply proved to be less costly than any other quality method for home construction," Douglas remarked. "The economies to a tract builder, concentrating on lower-priced homes, would be even more impressive.

"I know now I can repeat the Alply house in less time and at less cost than the first because the pioneering is done and my men are now familiar with the use of this new material."

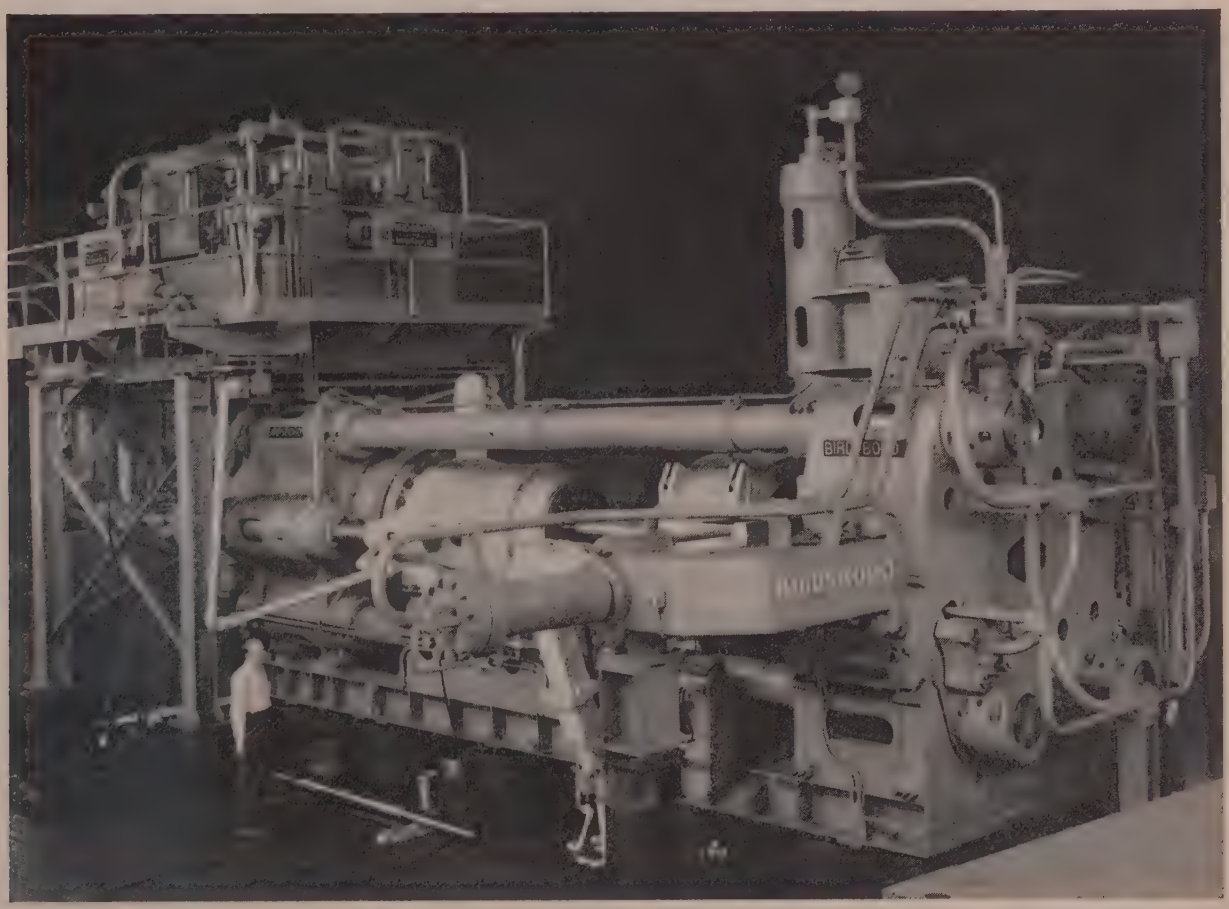
Wall panels of the Freeman home were positioned against interior wood

Before Alply panels were installed (left), interior stops were sealed with butane compound (far left). Roof panels (above) were easily installed by two men. Section was cut out of ceiling side to prevent heat conductance from inside to outside.

Latest **BIRDSBORO** *Press cuts costly extrusion dead cycle time for* **Revere**



• This 3000-ton oil hydraulic mandrel mover extrusion press, now in use by Revere Copper and Brass, is of the latest modern BIRDSBORO design. Extremely fast acting, it operates with a minimized dead cycle time. BIRDSBORO'S approach to proper component and circuit design results in rapid, fully integrated operation with maximum use of the press in actual extrusion of aluminum and aluminum alloys, including the high strength copper bearing varieties. Detailed descriptions of this and other advanced design hydraulic extrusion presses are available through your BIRDSBORO representative. *Sales Department:* Reading, Pa., *Engineering Department and Mfg. Plant:* Birdsboro, Pa., *District Office:* Pittsburgh, Pa.



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stops, and sealed with caulking compound. Exterior stops were then applied.

Roof panels were nailed down to four-by-fours with 40d nails. Twenty-four panels were used for enclosing exterior walls, and 60 for the roof. The reduction in the number of components greatly reduced field labor.

Recommended Panels . . .

The recommended panel for home construction is made up of: An outside layer of aluminum sheet with a baked enamel finish available in a variety of colors; a core consisting of 2 inches of foamed polystyrene insulation; an aluminum foil moisture barrier; and an interior unfinished material such as tempered hardboard.

Roof panels, with an overall thickness of 3 inches, consist of a textured aluminum sheet with baked enamel finish; about three inches of polystyrene; and used as the base for a built-up roof.

Although the exterior shell utilized panelized construction, interior partitions were made by conventional techniques to facilitate standard wiring and plumbing practices. Where electric outlets were required near exterior walls, floor type plugs were utilized.

Commenting on the home's contemporary appearance, Douglas noted that the panelized look gives a pleasing clean line to the home. The combination of floor to ceiling glassed-in areas, glass panels above each panel, an exterior balcony off the living room, and a three-arch barrel vault over the living room give the home owner the indoor-outdoor feeling now becoming popular.

■ ***Exterior screen at window (background) adds decorative effect to dining room. Screen consists of 5-inch diameter aluminum circles pop riveted together. Clear colored plastic circles are inserted at random to add color interest.***

The interior and exterior surfaces of the panels are light in color, providing a striking contrast with the walnut stained posts, trim and supporting beams.

Another unique effect which adds to the home's attractiveness is an exterior aluminum screen over floor-to-ceiling windows at the front corners. The screens consist of 5-inch diameter aluminum circles, pop riveted together. Multi-colored clear plastic circles inserted at random add color to the design.

Alcoa today anticipates rapidly developing interest in the Alply panel and its application because of the company's successful effort to reduce cost of the material through volume production. Steadily increasing consumption of the panels by the commercial and monumental construction industries has permitted larger production runs and price reductions of about 33% since 1957.

As use of the panels grows in residential building, still further price reductions are deemed possible, according to Keith K. Reid, manager of Alply panel sales. A wall panel recommended for home construction is available for less than $1 a square foot, if purchased in quantities sufficient to build approximately 10 dwellings. Larger quantities would reduce the price still further.

For roof decks, panel material would cost about $1.10 per square foot for quantities large enough for 10 houses. For 40 houses the cost would drop to about $1.00 per square foot.

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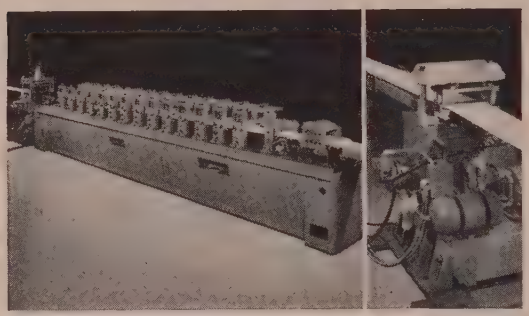

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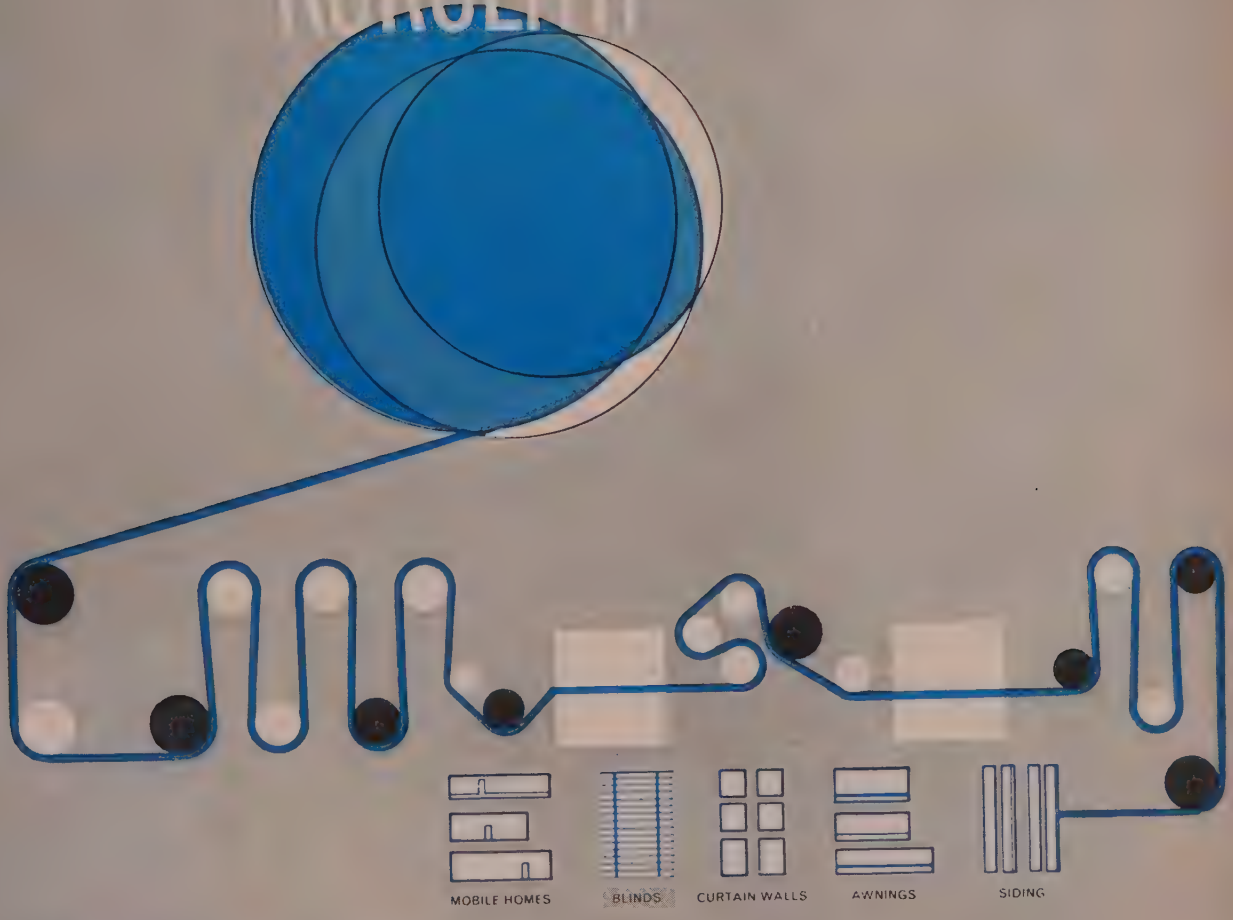

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Welding Aluminum

Part 5: Resistance Welding

Resistance welding aluminum is discussed in this segment. Covered are spot welding, used extensively in the aircraft industry; seam welding, recently adapted to the manufacture of tubing; and flash welding, widely used in the storm door and window industry.

Based on information supplied by Aluminium Laboratories Limited, Research Division of Aluminium Limited

RESISTANCE welding is the most economical of all processes for joining mass produced aluminum parts. Heat for such joining is generated in the work pieces by the resistance they offer to the controlled flow of a large electric current. During heating, pressure is applied to forge the parts together. No flux or filler material is required.

Three types of resistance welding are used most often: Spot, seam and flash. Spot and seam welding are used extensively in place of rivets. These processes are of particular advantage as practically no loss of strength occurs. For this reason they are both widely used in the aircraft industry for joining aluminum.

Seam welding, which is simply overlapping spot welds, produces gas and liquid-tight joints. Standard equipment welds aluminum up to 3/16-inch thick while special machines have been built to weld two thicknesses of ¼-inch aluminum plate. (Welders with 300,000 amp. capacity are available.)

Flash is used to butt weld tubes, bars, sections, wire, etc. Examples include welding mitre joints on window sash and welding aluminum to copper for refrigerator heat exchangers. Flash welding is used for such applications because it does not weaken the metal, requires little finishing, and produces quality joints.

Spot Welding

In spot welding the two parts are overlapped and pressed together between two electrode tips. Current is passed between the electrodes with the result that the two parts are fused together within a limited area or "spot," forming a cast slug of metal very much like a rivet.

Spot welding aluminum is similar to spot welding other materials. However, to obtain the best results certain characteristics of aluminum must be understood, and equipment and procedures carefully selected and controlled. Too much emphasis cannot be placed on control of the various steps, as very often the cause of inconsistent and poor welds is not a single wrong factor but the cumulative effect of several slightly incorrect or maladjusted factors.

Aluminum alloys have certain characteristics which require procedures that differ somewhat from those used on other metals.

The high electrical conductivity of aluminum alloys necessitates welding machines of relatively high current capacity. Thus some changes in the way in which the welding current is delivered to the weld are usually necessary before using conventional machines.

This high thermal conductivity affects the plastic range in which a weld can be made without melting too much metal. Therefore, the energy input must be controlled so that melting occurs at the interfaces while the surfaces in contact with the electrodes remain reasonably cool. For this, electronic timing controls are necessary to accurately control the duration of the high currents used.

Aluminum alloys, particularly the high strength type such as 7075, shrink considerably upon solidification. Unless adequate provision is made (low inertia on moving head), and procedures are followed to compensate for shrinkage, voids and cracks will result. Alloys 1100, 3003, 6063, 5052 and 6061 are not as susceptible to cracking during welding as is 7075.

The oxide coating found on all aluminum alloys usually has a high and erratic electrical resistance. Thus, to obtain strong, symmetrical and consistent welds, some form of surface preparation is generally necessary. However, if the coating is thin and has a relatively low and sufficiently uniform electrical resistance, satisfactory welds can be made without surface preparation other than cleaning.

The tendency of aluminum to alloy with the copper in the electrodes during welding has been overcome by development of new equipment and procedures. Proper preweld cleaning minimizes tip pick-up when appropriate equipment and welding procedures are used.

Weldability Ratings

All aluminum alloys can be spot welded satisfactorily, although some alloys and combinations cause more difficulty than others.

The high strength alloys are easier to weld since they have good resistance to sheet separation and have better weld strength consistency. However, as already pointed out, they tend to crack. In fact, shrinkage cracks in weld metal are confined almost entirely to the copper-bearing alloys.

The lower and medium strength alloys have opposite tendencies. Spot welds in these alloys are usually free from cracks and porosity, even under very adverse conditions, but suffer from greater surface indentation, sheet separation and inconsistent weld strength. Of these alloys, those containing chromium, such as 5052 and 6061, possess the greatest tendency towards porosity, particularly when fully work-hardened or heat treated.

Alclad alloys are usually more difficult to spot weld. The low resistance and

high melting point of the material at the interface tend to decrease weld strength consistency.

In the joining of dissimilar alloys, those possessing similar electrical resistivity and melting points are the easiest to weld, while those possessing the greatest divergence in these properties are more difficult.

Exact weldability ratings are difficult to establish. However, Table 1 is a guide to the weldability of some of the more common alloy combinations.

Spot welds in 1100, 3003, 6063, 5052 and 6061 alloys should behave as well in service as the unwelded parent alloy. Spot welds in Alclad alloys are protected from corrosion by their coating. Spot welds in bare high-strength alloys may be attacked preferentially under severely corrosive conditions. If so, paint applied after welding will provide some protection, particularly if the faying surfaces are covered. When spot welding a bare high-strength alloy sheet to a coated sheet, the coating will protect the bare metal. Naturally, protection will not last as long since one coating is protecting two alloys.

The primary function of a spot weld is to resist shear. Owing to the many variables involved, the strength of each spot weld in a joint may not be the same. However, they should all come within a certain range for the alloy and thickness used.

Therefore, it is necessary for the designer to know the minimum and average shear strengths of spot welds in the different gauges of the various alloys and combinations (given in U. S. specification MIL-W-6860).

Another important consideration is the spacing of the spots with respect to one another and the edges of the sheet (see Table 2). Do not change the minimum spacing between spots once the machine has been set up for a particular job, because one spot will partially short-circuit the current when making the adjoining spot.

A spot placed too close to the edge of a sheet may cause the metal between the spot and the edge of the sheet to bulge due to expansion and contraction forces in the weld. Closer spacings than recommended in Table 2 may be used with special techniques.

Spacings given in Table 2 also determine the minimum overlap of the two sheets as well as the minimum width of a flange or strip to be joined to the sheet. The minimum overlap or width should be twice the minimum edge distance plus the minimum distance between spots, if more than one row of spots is used.

Table 2 also gives the minimum unobstructed area around a spot that is

TABLE 1: Weldability of Commonly Used Aluminum Alloy Combinations (Based on Equal Thickness)

ALLOY AND TEMPER	1100-O 3003-O	1100-H14, H16, H18 3003-H14, H16, H18	5052	5052-H34, H36, H38	6063 T6, T5	6061 T4, T6	7075-T6	7075-T6 Alclad
1100-O	A4	A3	A4	A3	A3	A3		
	B1	B1	B2	B2	B2	B2		
3003-O	C1	C1	C1	C1	C1	C1		
1100-H14, -H16,	A3	A1	A3	A1	A1	A1		
-H18	B1	B1	B2	B2	B1	B2		
3000-H14, -H16, -H18	C1	C1	C1	C1	C1	C1		
	A4	A3	A4	A3	A3	A3		
5052-O	B2	B2	B2	B2	B2	B2		
	C1	C1	C1	C1	C1	C1		
5052-H34,	A3	A1	A3	A1	A1	A1	A2	A2
-H36	B2	B2	B2	B2	B2	B2	B2	B2
-H38	C1	C1	C1	C1	C1	C1	C2	C1
	A3	A1	A3	A1	A1	A1	A2	A2
6063-T5 & -T6	B2	B1	B2	B2	B2	B2	B2	B2
	C1	C1	C1	C1	C1	C1	C2	C1
	A3	A1	A3	A1	A1	A2	A2	A2
6061-T4 & -T6	B2	B2	B2	B2	B2	B2	B2	B2
	C1	C1	C1	C1	C1	C1	C2	C1
				A2	A2	A2	A2	A2
7075-T6				B2	B2	B2	B2	B2
				C2	C2	C2	C2	C2
				A2	A2	A2	A2	A2
7075-T6 alclad				B2	B2	B2	B2	B2
				C1	C1	C1	C2	C1

LEGEND:

A. EASE OF WELDING

1. Good welds over wide range of machine settings.
2. Good welds but special practices required; can weld over narrow range of machine settings.
3. Can be welded but material too soft to obtain consistent weld strength.
4. Difficult to weld — not recommended.

B. PRECLEANING

1. Easy to clean; may need no cleaning.
2. Chemical or mechanical precleaning necessary to make sound and consistent welds.

C. RESISTANCE TO CORROSION

1. Corrosion resistance of weld zone equal to parent metal.
2. Corrosion resistance of weld zone not as good as parent metal.

Adapted from AWS Pamphlet C1.2-53T entitled "Recommended Practices for Spot Welding Aluminum and Aluminum Alloys (Tentative)."

TABLE 2: Minimum Spot Weld Spacing, Edge Distance, Clearance[1] (in Inches)

Material Thickness	0.016	0.020	0.025	0.032	0.040	0.045	0.051	0.064	0.072	0.081	0.091	0.102	0.125
Minimum edge distance②	3/16	3/16	7/32	1/4	1/4	5/16	5/16	3/8	3/8	3/8	7/16	7/16	1/2
Minimum spot spacing③	5/16	3/8	3/8	3/8	7/16	7/16	1/2	1/2	9/16	5/8	5/8	3/4	1
Minimum distance between rows of staggered welds	1/4	1/4	5/16	5/16	5/16	5/16	3/8	3/8	7/16	1/2	1/2	1/2	5/8
Minimum overlap, flange width or "flat" required	3/8	3/8	7/16	1/2	1/2	5/8	5/8	3/4	3/4	3/4	7/8	7/8	1
Minimum unobstructed area required to place a weld diameter	7/16	9/16	9/16	11/16	11/16	11/16	11/16	11/16	11/16	11/16	15/16	15/16	15/16

NOTES: ① For combinations of uneven thicknesses use the thickness one lower than the heaviest gauge to be joined as the thickness controlling the above dimensions.
② Edge distance for maximum spot weld strength should not be less than 6 times the thickness.
③ Spot spacing for maximum spot weld strength should not be less than 8 times the thickness.

required to accommodate a normal straight electrode. Offset electrodes generally need the same or greater area depending on degree of offset and size of work pieces.

Occasionally it is possible to place spot welds in smaller areas, but only at the expense of operating efficiency and weld quality. An exception to this is long narrow grooves such as occur between corrugations or channels. In these cases, when using roller welding equipment, the width of the unobstructed space at right angles to the line of welds may be reduced to the minimum "flat" or flange distance given in Table 2.

Welding sequence should be considered during design. Spot welding will expand the metal slightly thus creating a tendency toward warping. Therefore, it is best to start welding at the middle of the sheet and work towards each end or side.

The prime objective of surface preparation is to ensure that contact resistance is uniform from spot to spot and from sheet to sheet.

In spot welding, the electrodes contact a certain surface area, through which the welding current flows as it passes from one electrode tip through the work to the other tip. Therefore, to produce high quality welds consistently, it is necessary to have a uniform contact resistance in these areas.

Clean Work Surface

To accomplish this, all foreign material must be removed from the surfaces to be welded. In most cases the thickness and uniformity of the oxide-film must be adjusted and controlled. If such pre-weld preparations are not made, electrode tips will deteriorate and further impair weld quality.

Grease, oil, dirt, identification markings, etc., may be removed by commercial solvents, such as mineral spirits, trichlorethylene, etc., or by other degreasing agents. The parts may be degreased by wiping, vapor dipping or spraying depending on part size and quantity. Some form of mechanical agitation should be used to help remove dirt and tightly adhering deposits.

Degreasing does not produce a chemically clean surface, so it is followed usually by cleaning with a hot alkaline solution (Table 3). Most aluminum alloys, as received from the manufacturer, are covered with a light film of oil which is easily removed by these solutions. But if parts are heavily soiled or covered with die lubricants they must be degreased before treatment in the hot alkaline cleaners.

After chemical cleaning parts should be rinsed thoroughly to remove all traces of cleaning solutions. Cleaned surfaces should be able to support a water film without a break. If breaks occur, cleaning should be repeated. A chemically clean surface is needed by chemicals used for oxide film treatment.

Instant Oxide Film

An oxide film forms instantly when aluminum and its alloys are exposed to air. The thickness and uniformity of this film vary with the alloy, exposure environments, and time. Thus, some means must be used to remove or adjust and control this oxide coating so that a low, uniform contact resistance is obtained. While it is relatively easy to remove the oxide layer by mechanical or chemical methods, it is not easy to do it evenly and at the same time promote the reformation of a thin and uniform film. Some chemical treatments (methods 5 and 6, Table 3), leave a very thin oxide film having a low uniform electrical resistance which changes very little during several months.

Mechanical methods using steel wool, wire brushes or abrasive powders require little investment or plant space. They can be confined to the area of the joint and are particularly useful on large sheets. However, mechanical methods are usually hand operations and are slow and often costly. It is also difficult to obtain uniformity.

Action must be sufficient to cut through the hard oxide film and yet gentle enough not to form an excessively rough surface in the relatively soft metal underneath. In the case of clad alloys, remove as little of the protective cladding as possible.

Bristles and Abrasives

Generally the gauge of wire bristles should not exceed 0.004 inch and abrasives should not be coarser than No. 240. The contact resistance of a surface mechanically cleaned is usually less uniform than that obtained by chemical means, this making electrode pick-up more troublesome. However, on parts that require several assembly operations, mechanical methods are often used prior to welding to augment previous chemical oxide film treatments.

Chemical treatments for the oxide film offer uniformity, low unit labor costs, and dependability. However, equipment is expensive, usually involving corrosion resistant tanks, temperature and time controls, handling devices and an exhaust system. Precise process control is also necessary to obtain consistent results. Also, the strong chemicals are a potential hazard to the operator and adjacent equipment.

Chemical methods of oxide treatment are recommended whenever the volume and/or quality of the work justifies the capital investment for equipment and operations (see Table 3).

The chemicals remove the original oxide film and replace it with a new one of uniform thickness and low electrical resistance. Solutions in Table 3 have a reasonably broad working range with regard to concentration, temperature and time of immersion, and the control of these factors is not too critical. Optimum conditions for any solution are best determined by tests.

All chemical operations must be followed immediately by thorough rinsing in cold water and rapid, complete drying. These operations are very important since they govern, to a large extent, the thickness and uniformity of the oxide film formed immediately after the aluminum is removed from the acid

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treatment solution. Use cold rinse water since hot water tends to increase thickness and electrical resistance of the oxide film. Forced warm air will speed drying.

Once material is prepared for welding, it is best that welding be done within 24 hours, though some treatments, such as methods 5 and 6 (Table 3), are effective much longer.

Uniformity of surface contact resistance is extremely important. Surface preparation must be properly designed and carefully controlled to prevent surface contamination from any outside source or through accidental reactions of the different chemicals on each other. This means that all chemical solutions must be checked frequently and kept in good working condition. Also, thorough washing and rinsing must follow each chemical treatment and all abrasives, steel wool, etc., used in mechanical oxide removal must be cleaned off.

The only sure way of setting up and controlling surface preparation operations is to measure the inter-sheet surface contact resistance. Measuring equipment may be purchased or may be made up by using a press and measuring instrument (see Fig. 1).

Be sure that surface resistance is always measured under standard conditions of pressure, applied current and electrode size and contours. Under those conditions, the inter-sheet surface resistance of properly cleaned aluminum alloys should range from 10 to 100 microhms while that of uncleaned stock may run up to 1000 microhms or higher. Sometimes contact resistance is measured from electrode to electrode. But this is not recommended since it is the resistance of the two aluminum surfaces in contact that is of prime importance.

Aluminum and its alloys can be spot welded satisfactorily with all general types of equipment. These types include single and three phase alternating current (a-c) welders and the electrostatic and electromagnetic types of stored energy welders. While conventional machines may be used, optimum results are obtained consistently only if certain refinements are made.

It is best to have a fast "follow-up" of the electrode pressure as the weld nugget contracts during cooling, this minimizing cracking and porosity. For this fast follow-up, welders for aluminum are usually fitted with special low-inertia heads, incorporating anti-friction bearings and other devices to lessen the force required to move the electrode.

Spot welding machines should have controls which permit gradual build-up of welding current. The thin oxide film present on the aluminum surface is pierced and broken up as the welding current builds up at the electrode-to-sheet and sheet-to-sheet interfaces. If the welding current is built-up too rapidly there is electrode pick-up, spitting, and metal expulsion at the sheet interface.

In single-phase a-c machines this gradual current build-up is obtained by the use of slope control.

A variable pressure cycle consisting of two or three stages is usually provided. In the first stage a high pre-weld pressure is exerted by the electrodes to seat them firmly in the aluminum and establish a good electrical contact. The pressure then may be reduced while the weld is being made and finally increased to a high pressure to forge the weld nugget.

Low pressure during welding eliminates excessive sheet separation while the high forging pressure reduces cracking. Thus, machine settings become less critical once the proper pressure cycle has been established, which increases the range in which good quality welds can be produced. Also, when the correct pressure cycle is employed, a weld of a given size can be produced with a lower welding current. However, the pressure cycle must be timed properly in relation to the welding current wave form.

Conventional single-phase a-c welders will produce good spot welds in all aluminum alloys. However, they place an unbalanced load on the electrical supply system especially when large capacity machines are used. This heavy load on one phase of a three-phase power supply causes an excessive voltage drop on the line which affects the performance of all other equipment connected to it. As it is a highly reactive load, its low power factor is an additional disadvantage.

These large variations in line voltage affect the performance of other single-phase a-c welders in use and produce non-uniform welds. The most satisfactory method of supplying power to large single-phase a-c welders is to use substations reserved for the purpose.

Conventional single-phase a-c welders

(Continued on page 78)

TABLE 3: Cleaning Methods Prior to Spot and Seam Welding

Method	Application	Procedure
1 Precleaner	All alloys and products to be resistance welded.	Remove identification marks with paint thinner or alcohol. Solvent degrease by vapor, dip or wash.
2 Mechanical Cleaner	All alloys. For cleaning small areas or very large parts that cannot be immersed.	Wire brush at surface speed of 4000 fpm with rotary brush, stainless steel bristles 0.003 or 0.004 inches diameter; or hand rub where required with steel wool or abrasive.
3 Heavy Oxide Remover	Heat treated alloys or badly stained parts may require removal of oxide film prior to one of these treatments:	Immerse in solution at 160°F for 20 to 50 seconds. (5% sodium hydroxide). Rinse in cold water. Rinse in room temperature concentrated nitric acid. Rinse in cold water. Quick rinse in hot water and dry rapidly.
4 General Purpose Cleaner	Used on all alloys when necessary to obtain uniform contact resistance.	Immerse in solution at 75°F for 2 to 6 minutes. (12% technical grade nitric acid) (0.4% technical grade hydrofluoric acid) (0.2% wetting agent (Nacconal NR or equivalent) Rinse one minute in cold water. Quick rinse in hot water and dry rapidly.
5 Alclad Alloy Cleaner	Alclad alloys and 1100 and 3003 alloys to retain uniform contact resistance indefinitely.	Immerse in solution at 190°F for 1½ to 3 minutes. (10% technical grade nitric acid) (6 ounces sodium sulphate per gallon) (0.1% wetting agent (Nacconal NR or equivalent)) Rinse vigorously 5 minutes in cold running water. Dry rapidly.
6 Bare Alloy Cleaner	Bare heat treated alloys to retain uniform contact resistance indefinitely.	Immerse in solution at 185°F for 1½ to 3 minutes. (15% technical grade nitric acid) (13 ounces sodium sulphate per gallon) (0.1% wetting agent (Nacconal NR or equivalent)) Rinse vigorously 5 minutes in cold running water. Dry rapidly.
7 Proprietary Cleaners	As recommended by supplier.	

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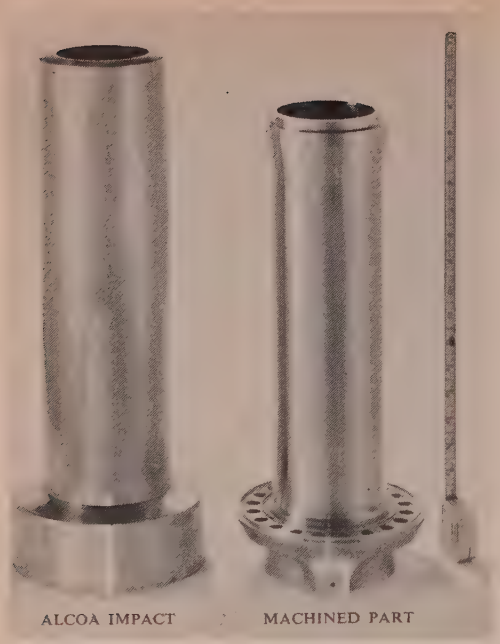

Use of an impact for this missile component provides significant savings in machining time and material cost.

Impact eliminates prohibitive waste of stock previously encountered in machining this air compressor valve from rod stock.

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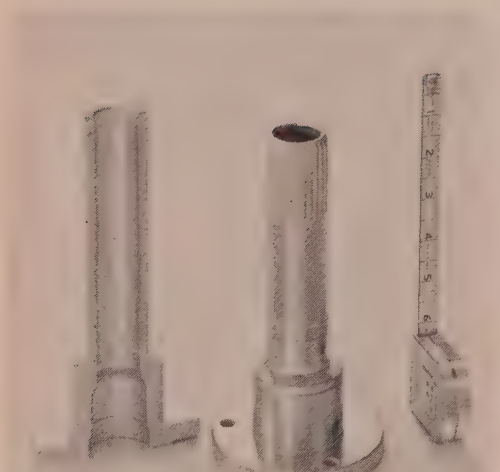
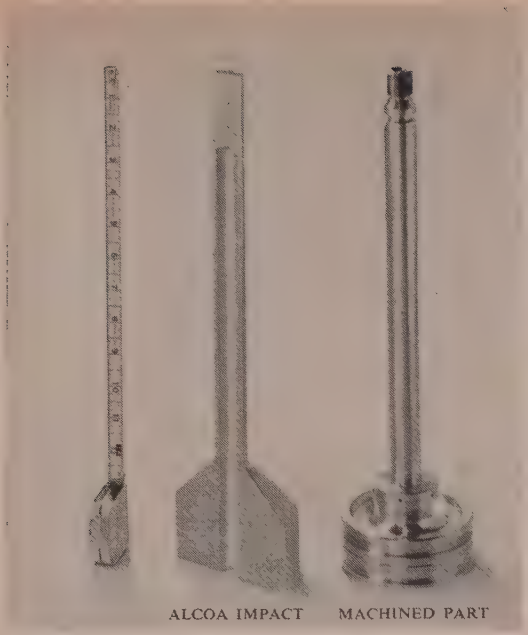


Impact replaces steel forging in which center hole had to be drilled. Cost of finished aluminum part is approximately half that of steel part.

Side-wall steps and grooves in the impact reduce hogging and milling operations in this missile component.

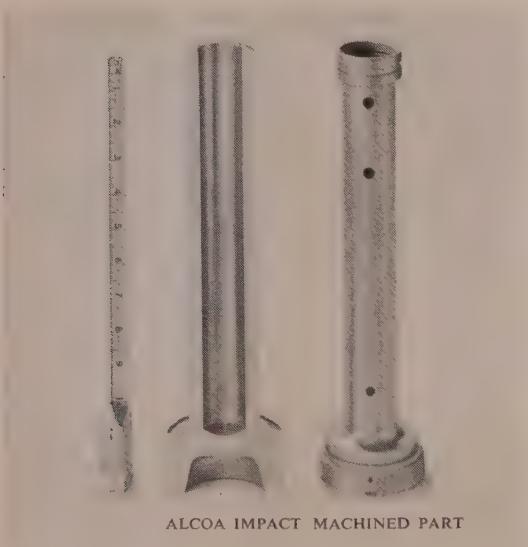


Impact's extremely precise center hole avoids costly deep drilling while impact's outside contour saves high machining chip loss.

(A) Impact incorporates close-tolerance indexing grooves and keys on both ends. Saves precision milling operations and reduces machining time and costs.

(B) Impact reduces machining waste and milling of flats—unavoidable if this sleeve cable connector were machined from heavy wall tubing.

puts the metal where you want it



Impact banishes deep drilling and wasteful machining required when machining this aircraft landing gear plunger from solid stock.

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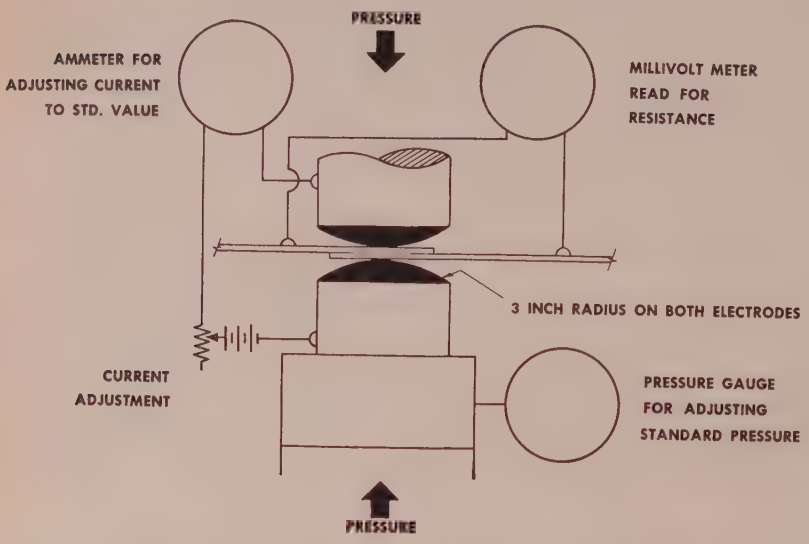
FIG. 1: Apparatus for Measuring Surface Contact Resistance Between Two Pieces of Aluminum


PRESSURE
AMMETER FOR ADJUSTING CURRENT TO STD. VALUE
MILLIVOLT METER READ FOR RESISTANCE
3 INCH RADIUS ON BOTH ELECTRODES
CURRENT ADJUSTMENT
PRESSURE GAUGE FOR ADJUSTING STANDARD PRESSURE
PRESSURE

should be fitted with precision electronic controls before attempting to weld aluminum. Such controls permit the use of variable pressure cycles because accurate timing is possible.

They should also be fitted with "slope" controls, which limit the first few pulses of 60-cycle current to allow the welding current to build up gradually, preventing electrode tip pick-up and extending tip life. Without slope control, the electrode tip must carry the full welding current on the first half cycle before the tip has a chance to sink into the softening metal and seat itself properly.

With slope control, the aluminum softens at the tip-work interface and allows the tip to seat itself before the full welding current is applied. Thus, when maximum welding current is reached, the current is distributed over the entire contact area so that excessively high current densities do not occur and cause sticking. The use of slope controls prolongs tip life 10 to 30-fold.

Taper or decay control permits a gradual decrease of the welding current after the weld has been made. This eliminates the necessity of long weld time by reducing severe quenching of the weld and the subsequent introduction of thermal stresses in the weld zone. A taper time of 13 cycles is required for best results. Taper control usually permits lower forging pressures to be used without risking weld cracks.

Combined slope and taper controls are desirable since the former eliminates the need for abnormally high initial pressures and the latter removes the necessity of accurate forging pressures.

Three-phase, direct energy a-c spot welding machines have been developed to reduce the unbalanced demand on the power supply. Also, the high power factor of these welders (from 85 to 95%) reduces the KVA load on the power source. These machines may be of the frequency-converter or dry-disc rectifier types.

Three-Phase Primary Unit

The frequency-converter machine uses a special transformer with a three-phase primary winding and a single-phase secondary. Current is fed into the three primary phases in pulses controlled by ignition tubes. The resultant secondary welding current has a basic frequency of approximately 5½ to 12 cycles per second.

The rectifier-type machine has a three-phase transformer that feeds low-voltage three-phase power to dry-disc rectifiers which, in turn, deliver direct current to the weld.

Three-phase direct energy a-c welders produce good quality welds consistently in aluminum. One reason for this is the partial control over the shape of the welding current wave front. This gradual increase of the welding current is similar to slope control used with single-phase a-c machines.

Stored energy welders accumulate energy at a low rate in a suitable storage system and then deliver it at a high rate when a weld is made. This reduces greatly the demand on power supply which is generally higher for aluminum than for other metals. Also, it is possible to control partially the wave shape of the welding current by the use of electronic controls. Thus, any desired rate of heat input and cooling can be obtained similar to slope and taper control on single-phase a-c machines.

The electrostatic system, probably the most widely used method of storing energy, employs a bank of capacitors with mechanisms for charging them to a predetermined voltage and discharging them through a suitable welding transformer. Electrostatic welders usually employ 1500 to 3000 volts to charge the capacitors through electronic rectifier tubes on each of the three phases of the power line. Thus, the line load is balanced and almost continuous. Owing to the high power factor, KVA demand is minimized as are power line disturbances.

In electromagnetic systems the source of energy is the electromagnetic field produced by sending direct current through the primary of a welding transformer. Upon interruption of the direct current, the magnetic field collapses and the energy stored in it is transmitted to the secondary of the transformer and the welding circuit. Thus, the output of these welders is dependent largely upon the speed and efficiency with which the primary circuit is interrupted.

The magnitude of the welding current is determined by controlling the magnitude of the primary current at the time of its interruption. As the charging current builds up in the primary circuit, a small secondary current is produced which preheats the work. This improves weld quality as it helps to offset the high thermal conductivity of the aluminum and slows down the cooling process.

Electrodes are usually made from a hard copper base alloy having an electrical conductivity of not less than 80% of the conductivity of pure copper. The hardness should be Rockwell B-60 or higher to withstand operating conditions. Pure hard drawn copper electrodes are not satisfactory. The manufacturers of electrodes should be asked to supply the proper electrode alloy for the aluminum alloy and temper to be welded.

Suitable Electrodes

Straight and offset electrodes are both suitable for spot welding aluminum assemblies. Use straight electrodes whenever possible. When offset electrodes are necessary the amount of offset should be held to the minimum permitted by the shape of the assembly being welded.

The contour of the electrode tip depends upon thickness of the material, type of welding process, surface appearance desired and distribution of the weld indentation required. Frequently it may be a function of the rigidity of the welding arms of the machine and the accuracy of the alignment of the two electrodes.

A spherical contour is usually preferred as it results in welds of good

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(3) Send for sound color film. Please indicate the date you plan to show the film and an alternate date.

(4) Write for names of manufacturers of Butyrate lacquer.

strength, symmetry and consistency. Also, it provides greater ease of alignment, minimum sheet separation and ease of maintenance. Normally the radius varies from 2 inches on 0.020 inch thick aluminum to 10 inches on 0.091 inch thick stock. Indentation can be minimized or eliminated by using a flat-faced tip on the critical side and a spherical-faced tip on the other.

Cooling of electrodes is necessary to retain tip contour and to reduce pick-up from the work. The temperature of the electrodes should not exceed 60°F except momentarily and then never exceed 90°F, at the instant of making a weld.

Cooling is done on standard machines by passing cold water through the electrode to within ¼ to ⅜ inch of the face. The inner cooling tube should extend to within ¼ inch of the bottom of the tip hole. The flow of cold water is usually 1 to 2 gallons per minute for continuous operation. If tap water is too warm refrigeration may be necessary. If an ample supply of water at temperatures of 50°F or lower is available, refrigeration is not necessary.

Keep Electrodes Clean

Tip pick-up is caused by aluminum from the work adhering to or alloying with the electrodes during welding. This alloy layer possesses a higher degree of electrical resistance than the electrode or welding surface and results in overheating which then increases pick-up. Therefore, to maintain a uniform tip contour and weld quality it is necessary to clean tips periodically.

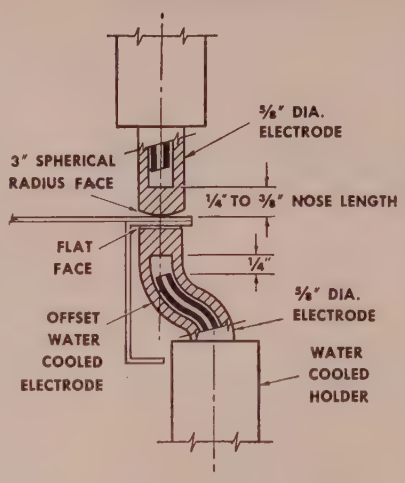
Cleaning may be done readily with Nos. 240 or 320 abrasive cloth or No. 00 emery cloth placed on both sides of an aluminum dolly or paddle containing a depression on each side to suit the contour of the electrodes. The dolly is clamped between the electrodes under light "cleaning" pressure and rotated until the surfaces are clean. It sometimes helps to use a good grade of machine oil on the cloth.

After cleaning, remove oil and abrasive particles, etc. It is also a good practice to make and check a sample weld to see that the tip contour has not been altered very much.

Tips should be cleaned before they mark or discolor work. Cleaning slows down production and reduces tip life, but insufficient cleaning causes poor quality welds and rapid electrode deterioration. With proper preparation electrodes should make from a hundred to several thousand welds between cleanings and from 5,000 to 10,000 welds before remachining.

When an electrode shows signs of wear, change in contour or requires cleaning too often, it should be taken out and machined. Quick-release electrodes have been developed which make it much easier and more satisfactory to replace them than to clean them in the machine. Cleaning and dressing are then done accurately on a lathe without interrupting production.

FIG. 2: Offset Water Cooled Electrode



Pieces to be joined may be jigged with clamps, spring fasteners, tack rivets or welds, etc. If this is not done, some of the electrode pressure will be used up in bringing the components into contact thus affecting the quality of the weld and perhaps causing buckling between spots.

Roller Tables Help

Slings or roller tables at the proper height are usually provided when welding large assemblies to keep the surfaces being welded normal to the electrode. If this is not done, oval or eccentric welds of doubtful quality may result.

There is a combination of settings that must be made on a spot welding machine for each job: Current, electrode pressure, timing.

Manufacturers of welding machines supply guides for machine settings for various thicknesses of material. Also, primary producers of aluminum will be helpful in providing welding schedules for the various types of spot welding machines.

Weld quality is affected by many factors and therefore trial is the only practical method to establish satisfactory machine settings. Sample strips of the same thickness and alloy as the material to be joined are welded and examined carefully by the set-up man or operator.

This is continued, altering the machine settings or electrode tips if necessary, until weld quality is shown to be satisfactory by actual test. These schedules should then be recorded for future use.

When unequal thicknesses are to be spot welded, machine settings and spot diameter are governed by thickness of material in contact with the spherical tip. If both tips are spherical, thickness of the thinner sheet governs the machine settings and spot diameter. When more than two thicknesses of material are to be spot welded, machine settings are governed by thicknesses of the outside sheets. In addition, use slightly higher values of welding current and pressure.

When the above factors are combined correctly a good spot weld having a thickness of 1/5 to 4/5 the combined thicknesses of the joined pieces will be formed.

Usually, when preparing for a new job, the machine is set at the recommended pressure and time, and then current adjusted until shear test specimens and sections show that the desired results are being obtained.

Current passing through tips and material supplies the welding heat. Very high currents are employed in spot welding aluminum, ranging from 14,000 amps for 0.016 inch to over 100,000 amps for 0.188 inch thick material. Since the current is applied only briefly, very accurate control is necessary. This is usually done electronically.

The electrical energy required is approximately proportional to the thickness of the metal being joined. The size and shape of the spot are directly influenced by the welding current. With increasing current the spot increases in thickness and diameter until it reaches the surface of the metal. In general, the strength of spot welds is more sensitive to changes in current than in pressure or time. Strength increases with higher current to the point where cracks and porosity appear, then it diminishes.

Electrode pressure holds the sheets together and aids fusion of the molten slug. It may be obtained by air or hydraulic cylinders or by springs. Pressure is adjusted on pneumatic and hydraulic machines by altering the unit pressure applied to the piston, whereas on mechanically operated machines the initial compression of the spring is adjusted.

Air or Hydraulic Pressure

Air or hydraulically operated electrode pressure devices are preferred because they offer a wide range of adjustments and settings can be duplicated. A low pressure produces larger and less uniform spots than a higher pressure, providing other variables remain constant. Low pressure may tend to cause porosity while high pressure, which boosts currents, results in stronger and more uniform welds.

The total load, although influenced by the sheet temper and permissible

indentation, is approximately proportional to the thickness of the work (150 pounds for welding two 0.010 inch thick sheets with increases of 100 pounds for each additional 0.010 inch thickness of sheet).

The pressures are quoted as total load on the electrode. Pressure affects the thermal and electrical contact resistance between the tip and the work, and also between the work pieces before welding. It also affects the depth of impression and may, if not correct, cause metal to exude between the parts being welded. Electrode pressure may be maintained constant throughout the entire welding cycle or it may be varied during welding. This variation is called program control.

The duration of welding current is governed to some extent by the amount of current used. The time is controlled and measured in a-c machines, usually by means of a synchronous electronic timer, thus eliminating mechanical contacts. Time is quoted as the number of cycles of a-c current. In machines operating on the accumulation of energy principle, time is measured from zero current at the start to approximately zero current at the end of welding.

Lack of sufficient time, where the current is adequate, will cause small porous welds, and, in the extreme, will fail to weld. Long duration of current permits electrodes to squeeze the molten metal while solidifying, which reduces porosity. Too long a duration of welding current is uneconomical, increases distortion, overheats the tips, and retards cooling. These produce cracks and columnar and layered structure.

Control Spot Weld Quality

Quality control of spot welds is necessary to ensure satisfactory behavior of joints in service. It will be discussed in three sections: Standards and specifications; inspection and testing; weld faults.

The standards and specifications to which welds are inspected and tested vary with the service requirements of the product. Pamphlets issued by the American Welding Society, Resistance Welder Manufacturers Association, Canadian Standards Association and others contain valuable information on the standards required in spot welds. In many commercial applications maximum strength is not required so standards less rigid than these are satisfactory.

Uniform quality of spot welds can be obtained only if the welding factors, once correctly selected, remain constant. It is the job of the operator as well as the inspector to see to this. Factors which must be controlled include: Uniformity of primary power voltage; cleanliness and efficiency of electrical contacts; proper contour and cleanliness of electrode tips; electrode pressure; low and uniform surface resistance of material being welded.

It is possible to interlock several spot welding machines to prevent them from operating simultaneously. This reduces peak loads and keeps the power supply relatively constant.

Inspection and testing of all spot welds is not economically feasible. Therefore, rigid control is exercised over machine settings, equipment maintaining these settings, and cleanliness of material. Alarm systems are available to indicate audibly and visibly great variations in current and pressure. At the beginning of each new job, and at frequent intervals, sample spot welds are made and tested to ensure that satisfactory quality is being obtained.

Inspection Methods

Visual examination is the chief means used by the operator and inspector in obtaining and maintaining required weld quality. The training of the operator and inspector to interpret correctly the causes of defects revealed by visual examination is very important. Visual examination will detect: Pick-up or surface burning; cracks; excessive indentation; sheet separation; weld expulsion; unsymmetrical welds.

Radiography may be used but equipment is relatively expensive, the assembly cannot always be taken to the X-ray machine, and trained personnel are required to interpret the radiographs. Therefore, radiography is used mainly in research to determine and evaluate properties and defects such as size and shape of nugget, cracks, porosity, Alclad inclusions, expulsions between faying surfaces, segregation, pick-up, weld structure and penetration. In production it is used principally to establish welding schedules.

Microscopic examination is used to reveal the size, shape, structure, and penetration of spot welds. To do this it is necessary to destroy the weld so microscopic tests are [illegible] on sample welds.

An average spot is selected from sample strip having the dimensions suggested in Table 4 and cut through the center of the weld at right angles to the plane of the joint. (The specimen may be mounted in plastic for convenience and handling during polishing and examining.) Specimens are then prepared and polished according to standard practice and may be etched.

A microscope of not less than x20 magnification is recommended when examining the samples for the following properties and defects: Weld structure; internal cracks; symmetry of welds; porosity; unwelded cladding; extent of penetration.

Penetration is measured best with a graduated lens and calculated as a percentage of the total thickness.

Mechanical testing is used to determine the shear and tensile strength, ductility and quality of spot welds. The shear and tensile strength of spot welds are usually determined by machines. However, qualitative tests such as peel, twist, vice shear and ductility require careful evaluation and interpretation by qualified personnel.

Shear Pull Test — Strips of metal welded together by one spot weld are pulled in tension until failure occurs. The spot weld should be in the center of the overlap which is equal to the width (see Table 4).

The strength of spot welds varies considerably and a deviation from the average as high as ±20% is assumed. When combinations of unequal thicknesses are tested, the thick strip may be reduced in width and length to that of the thin strip. The strength of three test specimens should be averaged to give a mean value, provided the variation is not greater than ±10% of the mean.

Strength Consistency Test — This test is similar to the above except that a series of 20 specimens, each containing a single spot weld, is made from two overlapping pieces of metal. The two pieces of metal are overlapped the minimum width (Table 4) and spot welds are made in the center of the overlap at a spacing equal to the minimum width.

The joined pieces are then cut in the middle of the spacing of the spot welds and at right angles to the overlap. The 20 specimens are then pulled in tension. The lowest average value of the shear strength may be compared to the values given in U. S. MIL-W-6860.

Twist Test — Specimens with a single spot weld are twisted apart about an axis running vertically through the center of the spot. This indicates the weld size, strength, and ductility. One sheet is clamped in a vice and the other

TABLE 4: Recommended Minimum Dimensions of Sample Strips for Microscopic and Mechanical Testing of Spot Welds

Thickness of Material, Inches	Minimum Width, Inches	Minimum Length, Inches
up to 0.031	5/8	3
0.032 to 0.045	3/4	4
0.046 to 0.059	1	4
0.060 to 0.070	1 1/4	5
0.071 to 0.100	1 1/2	5
above 0.100	2	6

about the spot until failure s. The size of the fused zone is .en measured.

Strength and ductility may be gauged by the degree of twist necessary to cause failure as well as the effort needed. Visual examination of the sheared surfaces will give an indication of the ductility. A rough and torn surface usually indicates high ductility while a smooth and granular surface usually indicates low ductility.

Vice Shear Test — This is similar to the twist test and is done in an ordinary vice. It is a qualitative test used to check the size, shape and nature of the weld.

Ductility Test — This is done on a thin strip cut from the center of a series of several welds. The strip is then bent sharply at the welds to reveal any discontinuities.

Peel Test — The peel test is used to reveal serious flaws or variations in the size and structure of spot welds. The specimen consists of two strips of material, having a width as recommended in Table 4, welded together by approximately 15 spots in the center of the strip and at the spacing required for production. The specimen is then pulled apart at right angles to the plane of the weld. A T-bar and vice or pliers may be used.

Weld Should Unbutton

The weld should fail by unbuttoning, and the diameter of the nugget should be approximately twice the thickness of the material plus 1/16 inch. The diameter structure and irregularities in the weld indicate the quality obtained.

Defective spot welds in aluminum usually occur because proven procedures or techniques before or during welding are not followed. The four factors which affect weld quality the greatest are: Surface cleanliness; uniformity of material; welding pressure; current. The most common weld faults are listed together with their causes and methods for correction.

Pick-up or surface burning is indicated by burned, pitted and discolored welds. This defect is usually the result of excessive heating or the following conditions: Improper surface cleaning; dirty electrodes; improper electrode cooling; improper electrode material; inadequate welding force; excessive welding time; excessive welding current; improper electrode contour or skidding.

Cracks in welds are usually caused by improper thermal and force conditions. Cracks or porosity visible on the surface are frequently associated with pick-up or surface burning and indicate poor surface cleaning. Cracks are caused by an excessively rapid thermal rise inside the weld and an excessively high rate of cooling or improper force.

To eliminate or minimize cracks, correct one or a combination of the following: Excessive penetration; insufficient force; delayed application of forging pressure; improper rate of current rise; improper electrode cooling; electrode skidding; improper electrode contour.

Excessive indentation of the tips into the surface of the material is indicated by depressions on the weld surface. However, some surface indentation is unavoidable since the weld metal shrinks on cooling. Further, it is difficult to avoid excessive indentation on soft material. Causes could be: Excessive force; improper forging cycle; improper electrode contour; weld metal expulsion; excessive surface heating; excessive welding current.

Sheet separation is indicated by a wide separation of the sheets adjacent to the weld. Generally, it is caused by improper fit-up of the parts and excessive surface deformation. Separation is usually greater with the softer alloys and formed parts. Some separation is encountered normally and may be considered satisfactory if it does not exceed 10% of the combined thickness when welding an equal combination.

Sheet separation may be a result of: Excessive force; incorrect electrode contour; tip misalignment; weld metal expulsion; excessive welding time; excessive welding current.

Weld expulsion is indicated by metal expelled from the weld, usually between the sheets. It is usually caused by extreme heat and improper force. The electrode force and contour should be sufficient to provide a pressure seal around the weld. Also, the faying surfaces must be properly cleaned. Other causes could be: Erratic contact resistance; electrode misalignment; electrode skidding.

Weld structure is a good indication of weld quality. Minor discontinuities such as transition zones from equiaxial to columnar crystalline zones, segregation within the weld nugget, and overageing of the base metal surrounding the weld, may act as stress risers. While the above conditions are known to reduce weld ductility, indications are that they are negligible as far as fatigue and static performance are concerned.

Internal cracks are undesirable but they are usually considered to have a minor influence on fatigue performance. This is based on the service performance of internally cracked welds in relatively severely loaded members. However, there is still some doubt about their effect on exceptionally heavily loaded structures subject to vibration. The factors which influence internal cracking are the same as those that effect external cracking.

The symmetry of a weld in respect to both horizontal and vertical axis of the joint is important. In good welding practice, it is desirable to obtain uniformly shaped welds, correctly located and aligned in the joint, since this type of weld is conducive to reliable, consistent reproduction.

Unsymmetrical welds may be caused by: Inadequate surface preparation; improper fit-up of parts; improper electrode contour; electrode misalignment; electrode skidding.

Porosity in a spot weld is generally caused by improper application of current and force. Very high rates of current rise, insufficient welding time and insufficient force, especially during the forging period, should be avoided to minimize porosity.

Inclusion of unwelded cladding is a discontinuation of the homogeneous structure of the nugget and may be considered a stress riser if it is located at the periphery of the nugget. It can be avoided with modern welding machines by a moderate increase of heat.

Weld penetration should not be more than 80% nor less than 20% of the sheet thickness. To overcome insufficient or excessive penetration check or alter one or more of the following: Welding current; weld time; surface preparation; electrode cooling; force; electrode contour.

Seam Welding

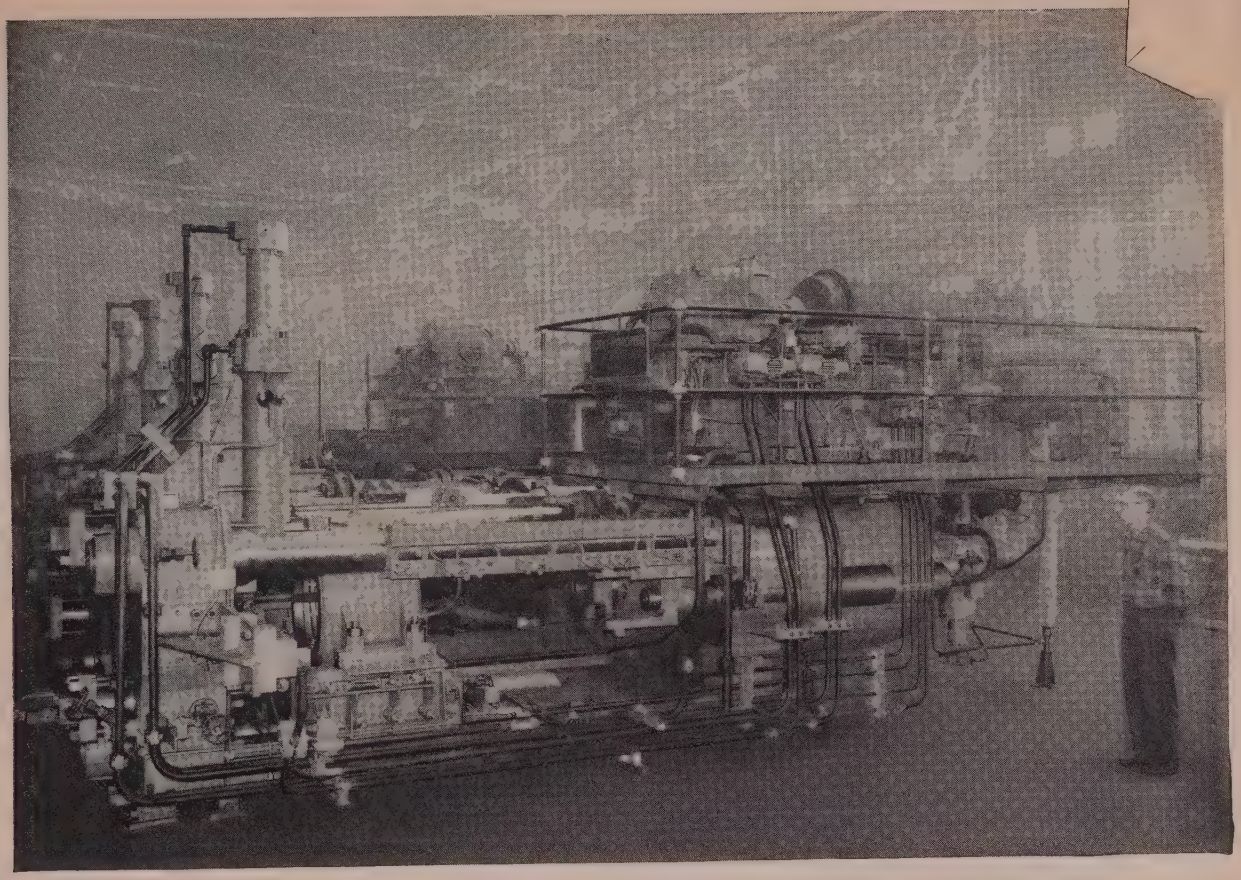
Seam welding of aluminum and its alloys is widely used in making gas or liquid-tight joints. By suitably adjusting the timing, a seam welding machine will produce a spot welded joint of equal quality to that produced on a spot welding machine and at a faster rate. This procedure is called "roll-spot" or "intermittent" seam welding.

Seam welding may often be performed on the same machines as spot welding except that the electrodes are replaced by wheels, one of which is usually driven at a constant rate. The other is generally an idler but may also be driven. If neither of the wheels is driven, the work is passed between them at a uniform speed by a special external attachment or drive.

Welding current may be applied when the wheels are in motion or at rest. Applying the welding current when the electrodes are motionless results in a superior surface finish. To accomplish this the machine must be equipped with driving and timing controls that stop wheels at each weld location and synchronize the current to flow at that period.

Higher welding currents and pressures are required for seam welding so it may be necessary to use machines of greater capacity than for spot welding.

Electrode wheels are generally made of the same material as the cylindrical



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electrodes for spot welding. They may vary in diameter from 6 to 10 inches, depending on the contour of the work, and from ⅜ to 1 inch in thickness. The wheel surface contacting the work may be flat, V-shaped with an included angle of 158° to 166°, or crowned with a radius of 1 to 6 inches. A flat wheel may be used with a crowned wheel if a smooth finish is desired on one side.

Electrode cooling may be done internally, but a more common practice is to spray water on the sides of the wheels and on the work. Where very high currents are used both internal and external cooling may be best. Rate of flow is usually 2 to 3 gallons per minute. This flow necessitates arrangements for collecting the water as it runs off the work and lower electrode wheel.

Lubrication of the wheel axle is important. Greases containing graphite aid movement, resist seizing when heated, and have low resistance to welding current.

Pick-up on the wheels is heavy because of the high currents and pressures used in seam welding. Wheels must be dressed with an abrasive cloth after 10 to 20 revolutions. Use a coarse emery cloth to produce a rough surface, which prevents slipping between the wheels and the work.

Considerably less dressing is necessary when using stored-energy types of machines. Automatic continuous dressing is possible using a contoured commutator stone or emery-covered dolly wheel in contact with the upper surface of the top wheel and the lower surface of the bottom wheel.

Getting Ready . . .

Preparation of material for seam welding, including degreasing, oxide-film treatment, jigging and positioning, is the same as that for spot welding.

Machine settings for seam welding are somewhat different from those for spot welding in that 25 to 50% higher current and 25% higher total load are used for similar thicknesses. As in spot welding, machine settings are largely a matter of trial and error.

Duration of current flow is only a fraction of that for spot welding. This short current duration and the need for overcoming shunting necessitates the use of high currents.

The individual spots in seam welds ordinarily overlap for gas or liquid-tightness, but may be separated to any desired distance by adjusting the timing and/or rate of travel of the wheels.

As in spot welding, thickness of the nugget is 1/5 to 4/5 the combined thickness of the pieces being joined.

Seam welding speeds vary from 1 to 10 fpm, depending on thickness of the material being joined as well as alloy and temper.

Quality control for seam welding is the same as for spot welding except that the pillow test for gas or liquid-tightness is used.

Two sheets 8 by 12 inches are used, and a nipple is welded in the center of one. The sheets are then welded together with a continuous seam around the four sides at a distance from the edge equal to ½ the minimum width given in Table 4. By connecting the nipple to a compressed air line or hydraulic hand pump, the pressure between the sheets may be increased to any desired value or until rupture occurs. The usual means of detecting air or liquid leakage may be used here.

Flash Welding

Flash welding is a resistance welding process that may be used to join aluminum and its alloys in the form of sheet, tubing, extrusions, wire, rod and bar. The strength of a flash welded joint is usually only slightly below that of the unaffected parent material.

Flash welding equipment is highly specialized and expensive. Therefore, it is employed generally on a mass production basis only.

A flash welding machine should be able to deliver currents of up to 100,000 amps per square inch. The machine should have suitable dies and die-clamping mechanisms to prevent the parts being welded from slipping during upsetting. One or both of the clamping dies must be able to be moved toward the other quickly to establish and maintain the flashing arc and to provide a very fast upsetting action once the pieces have been heated to the correct temperature.

The mechanism for actuating the moving parts and the movable die or dies is usually a motor-driven cam which gives a uniform forward motion and then a sharp blow to forge or upset the heated metal. The upset or forge pressure required is about two-thirds the tensile strength of the parent material.

The clamping dies may be made from hard drawn copper or copper alloys. They should possess good thermal and electrical conductivity and should not require water cooling except under severe full load operating conditions. The clamping dies must be contoured to fit the circumference or perimeter of the work and must contact at least 80% of the surface area being held by the dies.

Die length is governed by the nature of the work. Too short a length will cause crushing and marking. Also, a good electrical connection must be made. Axial alignment of the dies must be accurate and maintained within approximately 5% of the thickness of the material to prevent telescoping of the parts during upsetting. Die clamping pressure must be great enough to prevent any slipping of the parts during the upsetting action.

"Pinch-off" dies, used successfully on small sections, consist of steel skivers located inside the welding dies and are constructed so that their edges miss contacting one another by approximately 0.015 inch at the end of the upset action. The extruded flash has a web thickness of 0.015 inch at its base and is easily broken off.

See Equipment Manufacturer

It is general practice to submit flash welding problems to equipment manufacturers who then supply machines and dies satisfactory for the purpose.

Flash welding is usually preceded by edge preparation, degreasing and oxide film treatment. The latter two methods are the same as for spot welding.

Edge preparation guarantees surfaces to be joined will be parallel when fitted in the dies for welding. Generally, it is only necessary to produce a clean, smooth surface when cutting sections. Plain butt and mitre joints are commonly used.

Successful flash welding involves the establishment of a temperature gradient during the flashing and upset cycles to eliminate oxide from the weld line and, at the same time, prevent excessive recrystallization or overageing of the parent material. Adequate spacing is needed to provide metal which is burnt off or displaced during flashing and upsetting. A final die spacing is necessary to accomodate the excess metal pushed out by upsetting.

Flashing times vary from one to six cycles followed by an upset, in which the flashing arc is extinguished. The welding current is allowed to flow for a few cycles afterwards. The correct spacings and machine settings are best determined by trial and error, aided by the recommendations of the equipment supplier.

Major Suppliers of Resistance Welding Equipment

Acme Electric Welder Co., Los Angeles
Acro Welder Mfg. Co., Milwaukee
Ames Spot Welder Co., Inc., Brooklyn
Birdsell Mfg. Co., Palo Alto, Calif.
Bren-Weld Corp., Brooklyn
Eisler Engineering Co., Newark, N. J.
Electric Arc Inc., Newark, N. J.
Federal Machine & Welder Co., Warren, O.
Franklin Transformer Mfg. Co., Minneapolis, Minn.
Hoffman, R. W., Co., Inc., Chicago
Kirkhof Mfg. Corp., Grand Rapids, Mich.
Martin Electric Div'n, Detroit
Peer Inc., Benton Harbor, Mich.
Precision Welder & Flexopress Corp., Cincinnati
Progressive Welder & Machine Co., Detroit
Raytheon Mfg. Co., Waltham, Mass.
Resistance Welder Corp., Detroit
Sciaky Bros., Chicago
Taylor-Winfield Corp., Warren, O.

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Cast Aluminum Threadless Fittings Save Hours, Dollars In Rack, Railing Installations

Cincinnati contractor saw need for faster pipe rack assembly; idea for aluminum fittings solved problem, and created many new piping uses.

BACK IN 1948, employees of P. R. Hollaender, Inc., a plumbing contracting firm in Cincinnati, were putting together some pipe storage racks. Laboriously they cut pipe to proper lengths, threaded the ends, attached fittings, and finally fastened the components together.

As the long drawn out job progressed, P. R. Hollaender, a fretful witness to the operation, vowed that he would find a simpler, more economical procedure. He kept his promise; by 1950 he had patented a new kind of aluminum slip-on fitting which needs neither pipe threading nor welding. It fastens to the pipe by unobtrusive set screws. Not only is installation time cut 60 to 80%, but a 30% saving in overall cost is realized as well.

As is so often the case, the pipe and fitting combination which he conceived proved to have much broader application than he had originally intended — so broad, in fact, that it is used in hundreds of different kinds of guard rail, rack, frame and scaffold jobs.

■ *By using Hollaender cast aluminum fittings, a railing like this can be installed by a maintenance man who has no special skill in this field. A hex wrench is the only tool needed for fitting pipes together.*

11 Million Fittings Sold

Hollaender organized a company to produce and sell the fittings. Since Hollaender Mfg. Co. was launched, close to 11 million of the aluminum pipe fittings have been produced.

The range of Hollaender fittings is broad, too, including tees, elbows, crosses, and more unique designs, one of which permits three pipes to pass each other without cutting. Size range encompasses pipe sizes from ¾-inch to 2-inch outside diameter.

The high-strength fittings are sand cast, finished by belt sanding, grinding and tumbling. Rather than just spot check production for accurate size, the company gauges each part. Finally, the fittings are drilled and tapped and set screws are inserted using the Setomatic machines of Standard Pressed Steel Co., Jenkintown, Pa.

These machines have calibrated controls so that screws can be inserted to a desired depth. This is important in view of the variety of types and sizes of fittings. Changing the calibration on the machine to the proper insertion depth assures that the set screw is inserted deep enough into the rib to prevent backing out in shipment, but not deep enough to allow the point to extend into the inside diameter, thus impeding the insertion of pipe.

■ *Albert Penter, Hollaender's plant superintendent, spot checks an aluminum 3-way fitting before set screws are installed. Fittings have found many uses.*

Last year was an eventful one for Hollaender. Sales rose 33% and about 75 distributors were signed up. Hollaender bought some land and announced plans for a new foundry. He also bought an executive plane for more convenient coverage of his distributors and markets.

The reasons for this steady growth go beyond assembly speed and economy. Take the case of a large rack system designed for storage of a particular group of products. If, later on, another product line must be stored in part of this area, there will be no difficulty in dismantling part of the racks and reassembling them to accommodate the new line.

Aluminum's resistance to corrosion makes the system ideal for outdoor rack or railing use.

Hollaender greets with pleasure orders for sizeable installations — guard rails for big industrial plants, traffic control rails and box seat enclosures in ball parks — but seems to get just as big a kick out of the small, off-beat applications.

Teeter-Totters; Cattle Pens

Last year he sponsored a contest to learn who had developed the most interesting use for the fittings. He learned that a department store had used them to build a miniature Eiffel Tower. A monkey fancier used the Hollaender system to build a cage for his pets.

Hollaender fittings have been used to form teeter-totters, tennis court enclosures and tripods; for jungle gyms, voting booth frames, invalid walkers, catwalks, carports, cattle pens, and ballet bars.

The winning entry was a package of eight fittings and eight pieces of pipe which, when assembled, became a sukkah — a tent-like structure used in the Jewish religious ceremony celebrating the Harvest Season.

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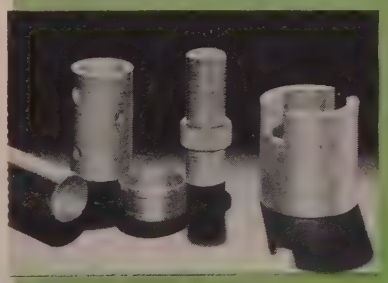

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News Products and People

Alcoa to Take Part in Los Angeles Urban Renewal Program

A "city of tomorrow" will be built on a Hollywood movie lot in the next decade through the joint efforts of Aluminum Co. of America and Webb & Knapp Inc., the largest urban renewal developer in the United States.

William Zeckendorf, president of Webb & Knapp, and Frank L. Magee, president of Alcoa, recently disclosed a partnership plan to build Century City. This will be a self-contained community for 30,000 persons, to be built on a Los Angeles tract to be acquired from Twentieth Century Fox Film Corp.

Directors of the film company have approved a contract, subject to stockholder approval, for Webb & Knapp to purchase the 265 acre site at a cash price of $43 million. Film company stockholders will vote on the proposal at a special meeting October 17.

Alcoa will participate in the property acquisition through the purchase of interest in 91091 Corp., a Webb & Knapp subsidiary established to acquire the land and to develop it.

Alcoa's primary interest in the venture is to develop new uses for aluminum in apartment housing and other structures.

"We regard this venture as an invaluable challenge to the type of ingenuity which, in less than a decade, has made the building field aluminum's largest market," Magee explained. He noted that 21% of annual aluminum industry production is currently going into architectural products.

"The aluminum curtain wall . . . has a great future as an aesthetic and practical wall facing for multiple-unit dwellings," he added. "We expect Century City to prove this conviction."

M. C. Schoetz, Alcoa's manager of building product sales, adds that new aluminum curtain walls will be used in the project which will make the buildings "vastly more livable."

Zeckendorf described the joint venture of a major building materials producer and a large-scale real estate developer as "a benefit to the entire aluminum industry."

Century City will be the largest privately financed urban development in the U. S. Over $250-million worth of buildings will be constructed. These will include high-rise apartments, offices, stores, a hotel and other structures to be erected in the next 10 years. Present plans call for ground to be broken next spring.

Pre-Cleaner Prepares Metal For Finishing Operations

A silicate-free pre-cleaning compound for aluminum and other metals is a new product of J. B. Ford Div'n, Wyandotte Chemicals Corp., Wyandotte, Mich. Called Aldet, it was developed as a companion for Wyandotte Mil-Etch, an alkaline compound for decorative and deep etching.

Aldet can be used for cleaning buffed aluminum prior to bright dipping, etching, anodizing, conversion coating, porcelain enameling and spot welding. It can also be used to clean galvanized iron, steel and terneplate where a mild highly buffered, synthetic detergent is desired.

According to the manufacturer, Aldet leaves no residual films to interfere with subsequent processing, and will not dull brightly buffed aluminum. When used for cleaning weathered aluminum, Aldet is said to eliminate pitting or streaking.

Black-Bottomed Pie Plate Bakes Better Crust, Faster

A new development in pie plate manufacture now allows the baker to achieve a better bottom pie crust bake with improved flavor in less time. Aluminum foil, traditionally an excellent baking pan material, now with a partially coated black bottom offers these additional advantages to the baker.

Ekco-Alcoa Containers Inc., Wheeling, Ill., has developed the partially coated black bottom pie plate. Prior to the availability of the black bottom, pies baked under conditions which permitted heat reflection produced soggy bottom crusts. This could only be eliminated with a longer baking time, but this often caused ingredients to boil away.

The black coating is applied only to the bottom of the pan and halfway up the side wall. The rest of the side wall and the rim are left uncoated.

The thermosetting coating is printed on the aluminum material prior to fabrication. It has exceptional heat absorption and heat stability and withstands all normal baking temperatures.

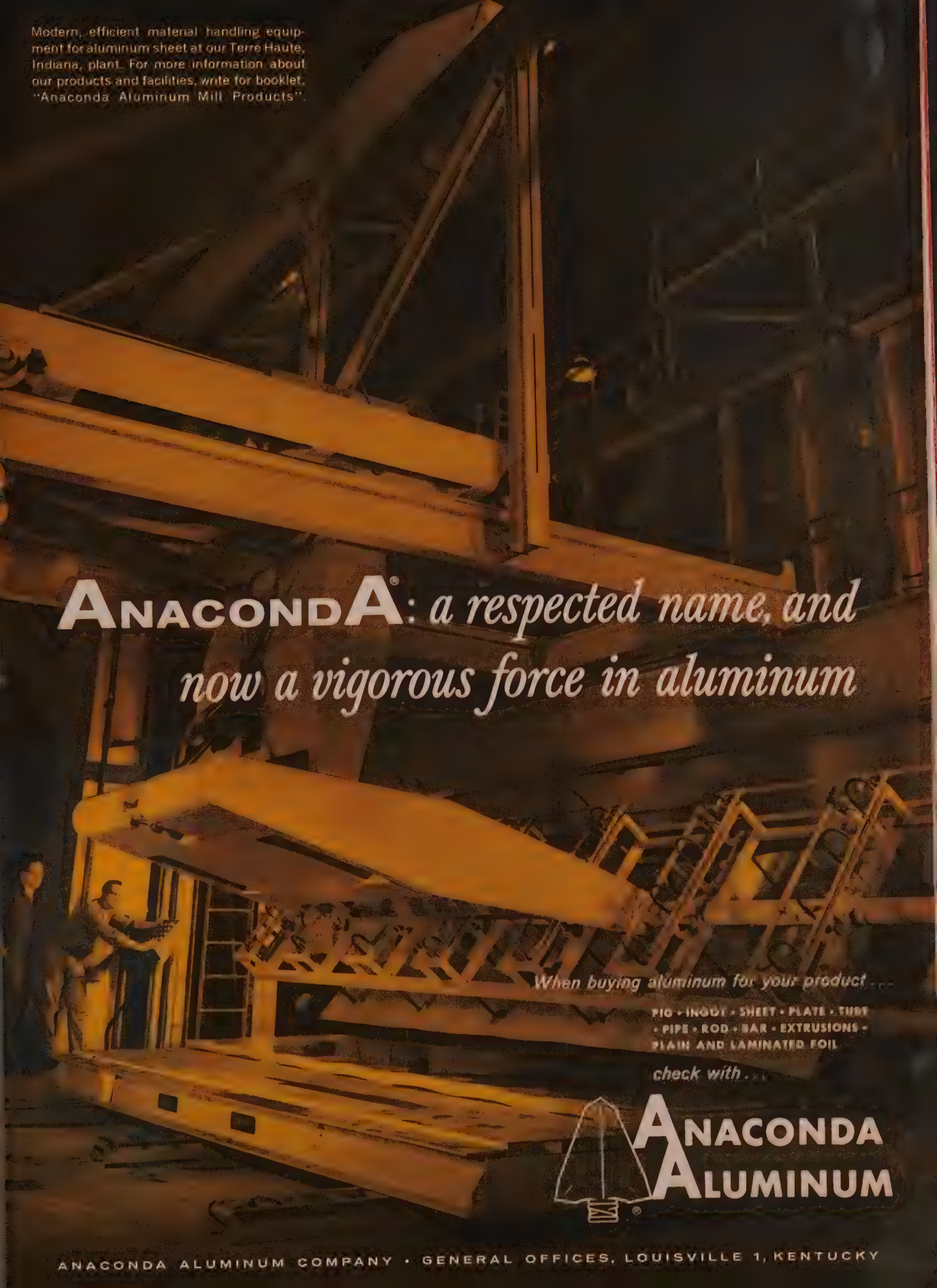
Ekco-Alcoa is now offering its complete line of stock 8 inch pie plates with the partial black bottom coating.

Aluminum Bezels Used In Portable TV Sets

A television manufacturer is using aluminum in its newest portable receiver to enhance appearance, increase structural strength and cut weight. Motorola Inc. recently introduced Astronaut, a 19-inch, all transistorized, self-powered, portable TV set using aluminum for bezel and chassis. The bezels are finished in either gold or silver-pigmented aluminum paint.

Motorola is repeating and expanding the use of aluminum in its current product line because of the successful use of the light metal in a slimline portable introduced last year.

The set was the first application for a die cast aluminum bezel, according to A. C. DeNapoli, Motorola's chief mechanical engineer for television.



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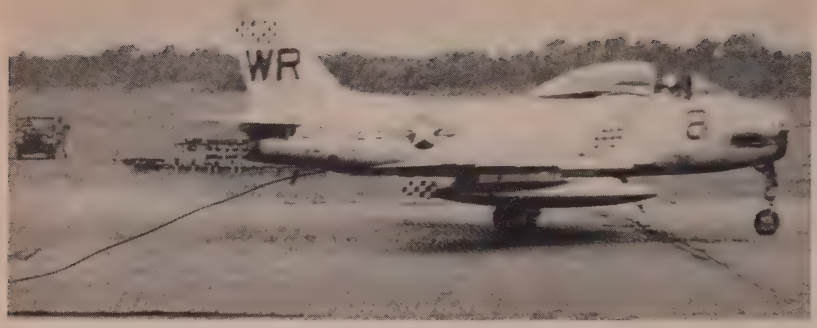


Jet Landing Strips Made of Aluminum Panels

Light, tough, aluminum panels are being used to convert rough, open country into smooth, safe landing fields for high speed tactical jets flown by the U. S. Marine Corps.

Developed and produced by Fenestra, Inc., Philadelphia, the welded all-aluminum panels can be airlifted by helicopter, or unloaded across a beach, and assembled quickly to form a solid landing strip. The airstrip surface — made of Alcoa 5456 sheet — resists scorching jet blasts and punishing carrier-type landings (above), essential to the Marine short airfield concept.

Strength and efficiency of panels were demonstrated in a recent full-scale expeditionary exercise. Working under timed, tactical conditions, Marines transported and assembled 12-feet-long, 2-feet-wide panels to establish an island airstrip.

Aircraft launching, arresting, and control gear were set up. Jets were operating from the strip well within the objective of 60 hours.

Fenestra developed the airstrip panels by modifying a basic airplane landing mat section. Corrugated sheet sections are used to form the core of a sandwich construction. These are encased with alloy 5456 sheet and continuously welded.

The aluminum panels can be assembled quickly in the field. Each panel has 27 downward curving fingers along one side, and an equal number of slots along the other. Panels are joined side-by-side by forcing the fingers of one through the slots of another. For end-to-end coupling, butted ends are bolted with aluminum bolts and seated by an impact wrench.

Fenestra is adapting the aluminum airstrip panel to launching pads for tactical missiles.

Reynolds Eyes Two Coast Canning Markets

If Reynolds Metals Co. has its way, two important California food industries will swing strongly to aluminum cans. W. O. Yates, vice president in charge of the Pacific Coast region, predicted that nearly all the 1961 frozen lemonade concentrate pack will be packaged in aluminum cans, and that within five years more than half of California's huge tuna, salmon and shellfish output will be canned in aluminum.

The forecast was made at the Western Packaging and Materials Handling Exposition in Los Angeles last month. Reynolds exhibited a complete line of aluminum packaging including cans for citrus concentrate, tuna, beer and oil, and aerosol containers.

Tinplate holds no price advantage over aluminum for lemonade, tuna, salmon and shellfish canning, Yates said. He based this on the significant freight savings and merchandising advantages offered by the lighter metal.

"California and the west also offer wide possibilities for aluminum beer cans," Yates pointed out. "Coors in Denver uses an aluminum 7 ounce can now and the Globe Brewing Co. in Honolulu has adopted a 12-ounce aluminum can. [Globe is the second Hawaiian brewery to adopt aluminum.]

"Within the next two years, we expect one or more major west coast brewers to introduce a 7-ounce can of aluminum."

Aluminum also will penetrate the west coast canning industry for frozen peaches, strawberries and other fruits, he stated. He noted that some western refineries already are using aluminum oil cans.

The lemonade can is a standard 3-piece can with cemented side seam. The body gauge is .008 inch; top and bottom are .009 inch. The potential for this application is 33,000 tons of aluminum per year, based on 1959 concentrate pack figures.

The tuna fish can is shallow drawn with body and bottom integral. The gauge is .010 inch and the potential tonnage for aluminum is about 13,875 tons a year. Reynolds expects initial commercial penetration in this market late this year.

Magnesium Gained Stature in 1959

New magnesium alloys with improved physical properties were developed and used in 1959, and improvements continued to be made in forming and fabricating techniques, according to an article in the 1959 Minerals Yearbook, a publication of the U. S. Department of the Interior, Bureau of Mines. Magnesium's importance as the lightest structural metal was highlighted last year by its use in the skins, framework, and instrument cases of the Vanguard weather satellites.

The Bureau of Mines report said that although there was virtually no change in world production of magnesium, consumption in the U. S. increased 17% above 1958, and exports rose more than 100%. New military and civilian uses of magnesium were noted.

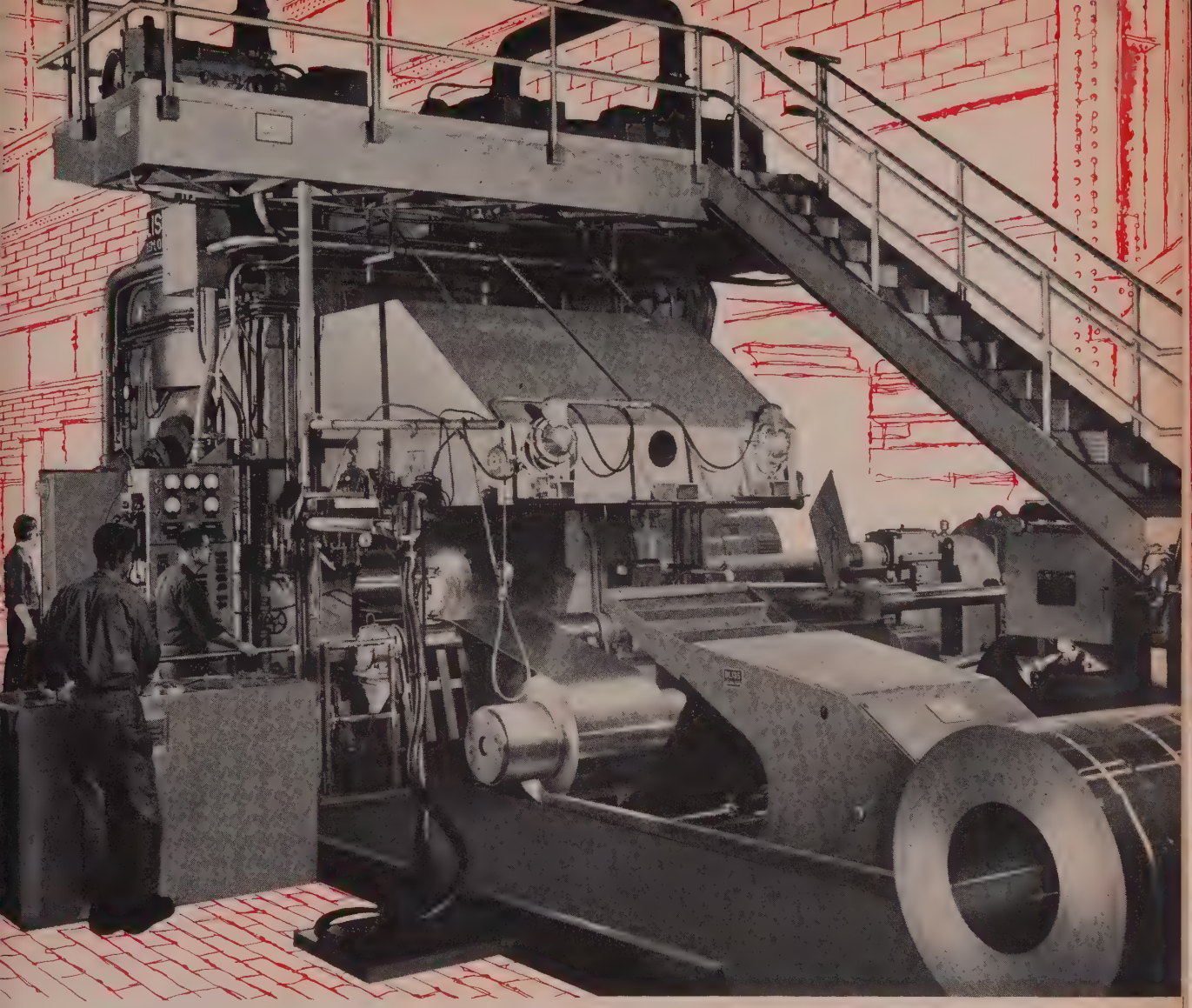
Magnesium Shipping Bins Cost Same as Aluminum

Magnesium Tote bins, about 40% lighter than the standard aluminum bin, are being sold at the same price as aluminum by Tote Systems Inc., Beatrice, Neb.

The price equalization policy, Tote officials hope, will allow more companies to turn to bulk handling for over-the-road shipping, since the magnesium bins can carry more payload while remaining within highway load limits.

Price equalization applies to all sizes of bins. This includes the 42 to 110 cubic foot capacity containers for dry product handling, and the 300 and 400 gallon capacity tanks for handling liquids. Other sizes are specially fabricated.

The bin, heart of the Tote System of bulk materials handling, serves as shipping container, storage unit and discharge hopper. Aluminum bins account for about 75% of all sales, officials say, but they expect the magnesium unit to become increasingly popular due to the new pricing policy.



SAYS ANACONDA ALUMINUM:

One good mill deserves another

Picking a Bliss rolling mill for their new aluminum plant in Terre Haute, Indiana, was easy for Anaconda Aluminum Company: for years these mills have had an outstanding performance record in the aluminum industry.

A new Bliss 14″ x 49″ x 66″ four-high one way cold mill capable of speeds up to 1200 fpm, it is equipped with the auxiliaries necessary to produce aluminum coiled sheet in 60″ widths and at specified thicknesses as fine as .006″. Bliss supplied the mill with complete entry and delivery equipment, including entry coil conveyor, coil lowering device, coil preparation station, mandrel-type payoff reel, coil buggy, and tension reel and coil buggy.

Anaconda's operation brought the "best" out of the Bliss mill as plant management found its production record to be excellent and economical, too. This installation is just one more example of the acceptance of Bliss rolling mill equipment. For others, in both ferrous and non-ferrous operations, write us today for a copy of our 84-page Rolling Mill Brochure, Catalog 40B.

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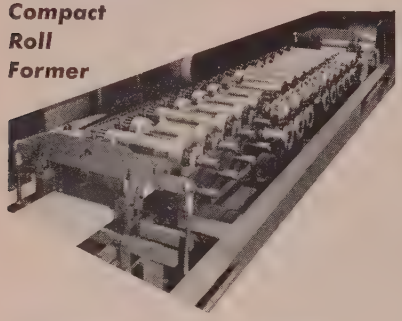

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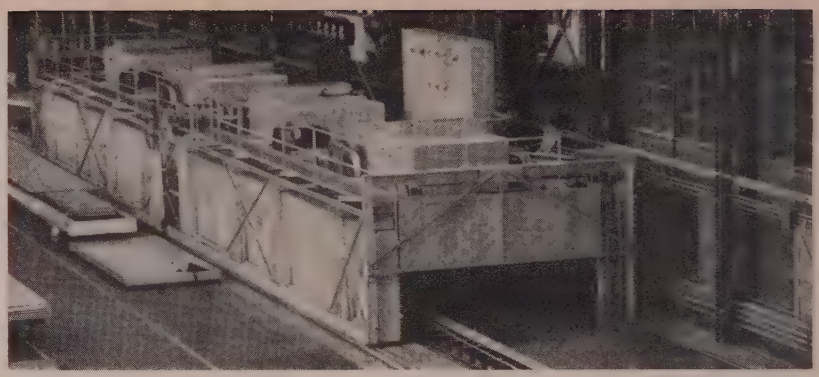


Self-Motivating Ageing Oven Cuts Between-Load Down-time

A self-motivating aircraft plate ageing oven that can move over a load, properly treat it, and then move away from the load, has been installed by the Lanly Co., Cleveland, in Reynolds Metals' McCook, Ill. plant.

Lanly claims that the 16-foot wide, 102-foot long oven greatly reduces downtime because loads to be heat treated can be jigged in a normal temperature atmosphere using overhead cranes. Once placed, the oven slides over the load and heat treats it.

The normal cycle is: Load is placed on a stationary hearth in front of oven; doors are raised at both ends of oven; electrical supply is disconnected from source; oven is moved over load; doors are lowered; heating elements connected; and heat treating started.

When treating is completed, the oven is merely backed away. The load is removed, another positioned, and the cycle started again. According to Lanly, removing a finished load and jigging another takes only minutes. With a conventional installation, the oven would have to be cooled so workmen could enter to jig another load. Cooling takes a long time and results in another work stopper: heat lost must be regained for subsequent treating.

New Adhesives Line Solves Many Problems

Important qualities are reported for the new line of structural adhesives introduced earlier this year by Minnesota Mining & Mfg. Co., St. Paul, Minn. The line includes a thermo-setting film, and one-part heat curing and two-part chemically curing liquid, modified epoxy adhesives.

Scotch-Weld thermosetting film adhesives provide uniform adhesive thickness throughout the joint, controlled confinement of adhesive to the immediate bonding area, clean bonding operations and simple application procedures. Film adhesives do not contain solvents which eliminates fume disposal and drying problems. They can be die cut into complicated shapes if desired. Scotch-Weld film adhesives provide room temperature overlap shear strengths up to 4200 psi, with extremely high peel strengths in the range of 100 pounds per inch width. They have excellent resistance to water, oils, salt, fuels and 300F dry heat, 3M said.

Scotch-Weld one-part liquid modified epoxy adhesives contain a latent hardener which eliminates the need for weighing and mixing operations of the hardener and base resin by the user. In addition to application time savings these adhesives have an unlimited working life. This type of adhesive must be heat cured to obtain high shear strengths.

These adhesives are self-filleting which makes them excellent for honeycomb sandwich construction. They do not give off by-products during curing, have excellent void filling properties and require only contact pressure for curing, eliminating the need for expensive jigs and fixtures. These one-part liquid epoxy adhesives provide room temperature overlap shear strengths up to 5500 psi, fair peel strength and excellent resistance to water, oils, salts, fuels and 300F dry heat.

Scotch-Weld two-part liquid modified epoxy adhesives require mixing and weighing operations of the hardener and base resin by the user but do not require heat and pressure for curing. The hardener added to the adhesive base at time of use causes a heat producing chemical curing reaction. This characteristic makes this adhesive useful in applications where heat and pressure are not practical in making a high strength bond.

Like the one-part epoxy adhesive, they are self filleting, have void filling properties, do not give off by-products during curing and require only contact pressure for curing. These two-part liquid epoxy adhesives provide room temperature overlap shear strengths up to 3200 psi, fair peel strength and excellent resistance to oils, fuels and 300F dry heat.

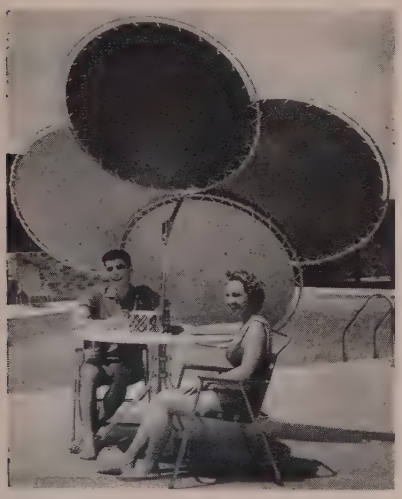
Aluminum Yacht Sets Class Speed Record at 22.8 MPH

Jigmil IV, the world's largest aluminum yacht, has returned to its home port at the Grosse Point Yacht Club sporting a 22.8 miles per hour class speed record achieved in trial runs.

The sleek 72 foot, 2½ inch craft is owned by industrialist Charles B. DeVlieg of Royal Oak, Mich. The yacht gets its name from the Jigmil, a machine tool invented by DeVlieg in 1941.

Jigmil IV used 35,000 pounds of aluminum in the hull superstructure, furniture, equipment and other applications. It was built by the Burger Boat Building Co., Manitowoc, Wis., with assistance from Reynolds Metals Co., which supplied the metal. Naval architect J. B. Hargrave was design consultant.

The aluminum boat weighs eight tons less than a similar steel craft. Hargrave says the ratio of speed to weight in a 40 foot aluminum boat is about one mile per hour gained for every 1500 pounds saved, which accounts for the *Jigmil's* speed.



Round Aluminum Sections Form Patio, Beach Sunshade

A smart new sunshade, said to be as stylish as a bathing beauty on the beach, is being manufactured by Clover Leaf Industries Inc., 211 Maplewood Lane, San Antonio, Texas. It comes in any combination of pastel ivory, rose, blue and green.

The leaf-like aluminum sun shield is produced in four sections, with each circular petal being 48 inches in diameter. Total diameter of the completed unit is eight feet. The Tone-Cote aluminum sheet, supplied by Alcoa, has a waffle-like pattern to minimize glare.

For strength, the large aluminum discs are laced to circular frames with white nylon rope. They are adjustable to three positions for optimum sun protection.

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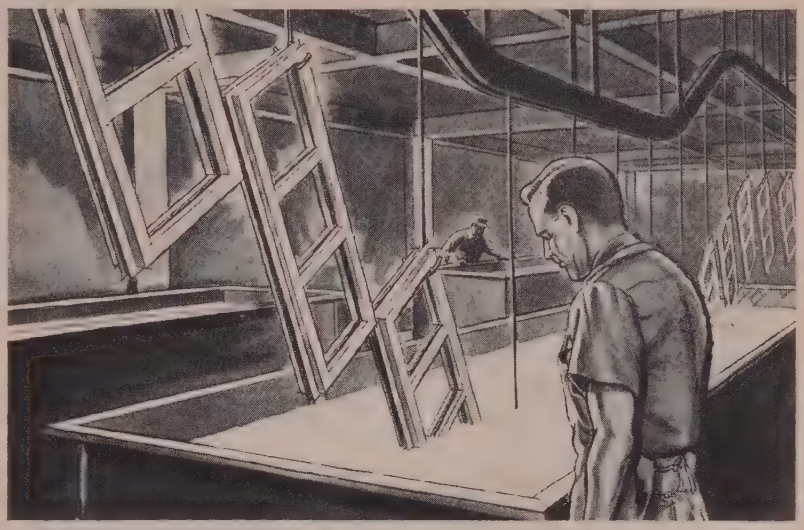

Oakite controlled aluminum etch provides safe, uniform mat finish

When your aluminum parts come out of an Oakite etching bath, you know exactly how deep an etch to expect. To give you this sure control, Oakite provides a variety of alkaline etching compounds. Each has its own rate of 'bite' and each is safe because the rate is dependable and uniform.

For instance, if you want a fine grain etch at moderate cycling speed—Oakite Composition No. 30 might be recommended by your Oakite man. Or, if you want a faster or deeper etch—Oakite 60, 130, or 160 might be the best choice.

Oakite controlled etching gives you a perfect satin finish when you want to enrich the natural beauty of aluminum, as on window frames or storm doors. When you want to prepare aluminum for paint, anodizing or lacquering, you get just the mat finish you need.

All Oakite alkaline materials are controlled to provide an identical rate of etching, batch after batch. One material is exactly right for your process, your alloys. Which one? Ask your Oakite man, or write for more information to Oakite Products, Inc., 45B Rector Street, New York 6, N. Y.

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Rolling Mill for Ghana; Brazil to Increase Capacity

An aluminum rolling mill will be installed next to the factory of Ghana Aluminium Products Ltd., Tema, associated company of Aluminium Ltd. The mill, which will cost about $2,750,000, will serve the entire sheet products market requirements of Ghana. Production is expected to begin in early 1962.

The rolling mill is the third stage in the company's expansion program. A second factory to produce a wide range of aluminum products is in advanced stages of construction.

In Brazil, the country's two primary aluminum producers are making plans to increase total annual capacity from the current 18,000 tons to 40,000 tons.

Aluminio do Brasil, S. A., wholly-owned subsidiary of Aluminium Ltd., operates about one-third of the aluminum fabricating facilities in Brazil. This firm in turn has a production subsidiary, Aluminio Minas Gerais, S. A., with present capacity of approximately 10,000 short tons. Plans call for this to be upped to 19,000 short tons.

The second Brazilian producer, Companhia Brasileira do Aluminio, owned by local capital, will expand capacity to 22,000 tons per year.

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Ventilated Soffit System Is Simple to Install

A new simpler-to-install ventilated aluminum soffit system has been designed by Reynolds Metals Co., Richmond, Va.

Prefinished with a durable baked-on enamel, the new soffit system eliminates peeling and warping of vulnerable eave overhangs and the need for frequent repainting of these hard-to-get-at areas, says the firm.

The new system is installed by cutting the soffit material (supplied in 50-foot rolls) to exact length required and slipping it into place through aluminum supporting channels nailed to the building. A plastic rod then is pressed into place to hold the edges of the soffit sheet and seal them. The aluminum supporting channels serve as fascia and freize boards.

The soffit material, crimped and stucco-embossed, comes perforated or non-perforated. It is adaptable to any size or type of eave overhang, gable-end overhang, porch ceiling, carport, entry way. It has other applications, too, says Reynolds. The soffit material is available in 12, 18, 24, 30 and 48-inch widths.

Aluminum Extension Ladder Is Mobile, Self-Supporting

A two-stage, self-supporting extension ladder made of aluminum can be used in places where conventional ladders are useless (see picture). The Bally-Hi is a product of the Ballymore Co., West Chester, Pa.

The frame is an extruded aluminum channel; rungs are extruded tube swaged to the channel; and grab rails are tubing TIG-welded to the channels. Alloy 6063-T6 is used.

The frame of the ladder is on wheels for mobility and is equipped with outriggers for extra support when the ladder is extended to its full 25-foot height. When fully collapsed the unit is only 77 inches high.

Pull-off Top, Foil-Paper Laminate Being Tested On Frozen Juice Cans; Steel Has New "Thin Tin"

A can boasting two new developments — a quick-opening aluminum top and a low cost foil and paperboard rigid shell — leads aluminum's latest bid for prominence as a material for cans.

The new container is the result of joint development work by United Shoe Machinery Corp. and Aluminum Co. of America. Right now, the can is being market tested in Providence, R. I., as a container for Minute Maid frozen orange juice concentrate. Consumer reaction is being measured.

Early users of the new containers are enthused over the can top's quick-opening device, reports Alcoa. The device uses an aluminum tab with a loop finger opening welded to the top. By merely lifting the loop and pulling, the tab instantly tears out a thin scored strip of aluminum. The top comes off with the strip, leaving a clean, smooth edge.

According to United Shoe and Alcoa, the aluminum top could easily become the standard opening device for metal cans. Both firms say the top can be adapted to cans for sardines, tuna fish, soup, canned meats, etc. Another application could be for cold drink cans. Once the top is torn out the container could become a tumbler.

Adding to the versatility of this development is the fact that the tear-out aluminum top may be used on tinplate can bodies.

The other half of this can team — the rigid contained body — is called Safe Pack. Sides of the Safe Pack body can be a lamination of paperboard, sandwiched between two layers of foil; or, of one layer of foil with paperboard, depending on the product being produced. Can ends are aluminum.

The lamination is supplied in coil form, so container sides can be rotogravure printed before the can is formed. The container is designed for forming, filling and sealing on one continuous production line.

As yet, there are no production facilities in the aluminum or package making industries capable of mass producing these containers. Existing aluminum and paperboard containers were made on pilot plant facilities, and tear off tops on laboratory equipment.

Enough cans have been produced for a six to eight week consumer test. If the test is as successful as expected, Minute Maid will adopt the top for national use.

While preparations were being made for the Providence test U. S. Steel announced a new canning material — Ferrolite — which is priced below standard metal. Ferrolite is a tin-plated steel half as thick as conventional tinplate.

Materials similar to Ferrolite are being experimented with by Jones & Laughlin Steel Corp., National Steel Corp., and Youngstown Sheet & Tube Co. But these firms say their experiments are nowhere near completion.

However, regardless of where development stands, such experimentation serves notice that the steel industry is not going to easily give up its can market — which consumes approximately 9% of all steel sold.

The price of Ferrolite per base box ranges from $6.10 to $6.65. Conventional tinplate sells for $9.10. Mass production costs of cans made from the new tin have not yet been determined.

Aluminum six-ounce fruit juice cans with inside enamel, outer decoration and varnish cost $21.92 for every thousand produced. Similar cans produced of conventional tinplate cost $23.59 per thousand. According to these figures "thin tin" has a long way to go to beat aluminum can production costs. (See article on aluminum prices, p. 34.)

Other facts about Ferrolite: It will be available in quantities shortly; though it weighs half as much as conventional tinplate, aluminum is still considerably lighter; its producer cautions that "can makers will have to learn how to use the new material."

The almost simultaneous announcement of these new developments has made newspapers and magazines more vividly aware of the battle of materials going on. In a recent issue, Barron's *National Business and Financial Weekly* said, "To many, this new climate (of increased competition) right now, must seem both unfamiliar and unfriendly. Ultimately, however, it holds vast promise for consumers and producers alike . . . "

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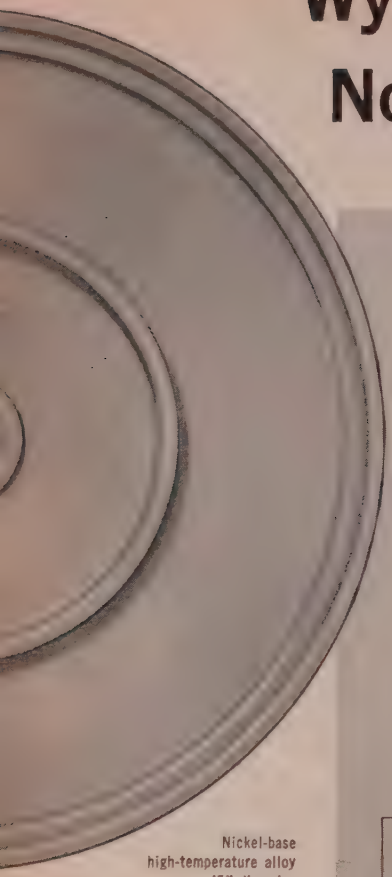

Nickel-base
high-temperature alloy
45" diameter
520 pounds

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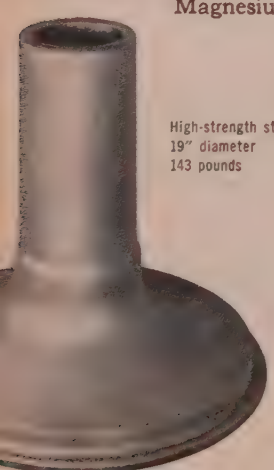

High-strength steel
19" diameter
143 pounds

PHYSICAL PROPERTIES

	ALLOY*	TEST TEMPERATURE °F.	HEAT TREAT	GUARANTEED MINIMUM ULTIMATE TENSILE STRENGTH PSI	GUARANTEED MINIMUM 0.2% YIELD STRENGTH PSI	GUARANTEED MINIMUM ELONGATION %	TYPICAL VALUES ULTIMATE TENSILE STRENGTH PSI	TYPICAL VALUES 0.2% YIELD STRENGTH PSI	TYPICAL VALUES ELONGATION %
TENSILE AND YIELD STRENGTHS	Waspaloy	RT	A	175,000	120,000	15.0	194,000	136,000	24.0
		1000	A	162,000	112,000	13.0	175,000	124,000	23.0
	René 41	RT	B	180,000	132,000	12.0	200,000	150,000	15.0
		1400	B	135,000	115,000	13.0	145,000	125,000	18.0
	Astroloy	RT	C	190,000	138,000	10.0	205,000	152,000	12.0
		1400	C	150,000	122,000	12.0	160,000	132,000	15.0
	U-500	RT	D	175,000	120,000	10.0	195,000	135,000	12.0
		1400	D	125,000	105,000	12.0	140,000	120,000	15.0
	M-252	RT	B	170,000	115,000	15.0	185,000	125,000	20.0
		1000	B	160,000	105,000	15.0	165,000	115,000	22.0

	ALLOY*	TEMPERATURE STRESS	GUARANTEED MINIMUM	TYPICAL VALUES
STRESS RUPTURE	Waspaloy	1350°F.—70,000 psi	70 hours—6% Elongation	130 hours—16% Elongation
	René 41	1350°F.—85,000 psi	30 hours—8% Elongation	60 hours—15% Elongation
	Astroloy	1800°F.—20,000 psi	20 hours—7% Elongation	35 hours—12% Elongation
	Udimet 500	1650°F.—25,000 psi	30 hours—6% Elongation	55 hours—12% Elongation
	M-252	1500°F.—40,000 psi	30 hours—8% Elongation	55 hours—16% Elongation

NOTE: The guaranteed minimums are based upon radial and tangential test locations.

COMPOSITION AND HEAT TREATMENT

	ALLOY*	ELEMENTS C	Cr	Mo	Co	Ti	Al	B	Ni
CHEMISTRY	Waspaloy	.08	19.0	4.3	13.5	3.0	1.4	.004	Balance
	René 41	.08	19.0	10.0	11.0	3.1	1.6	.004	Balance
	Astroloy	.05	15.0	5.0	15.0	3.5	4.3	.030	Balance
	Udimet 500	.07	18.5	5.0	18.3	3.0	3.0	.003	Balance
	M-252	.15	20.0	10.0	10.0	3.0	1.3	.002	Balance

HEAT TREATMENT	A.	1850°F.—4 hours—OQ; 1550°F.—2 hours—AC; 1400°F.—16 hours—AC
	B.	1950°F.—4 hours—AC; 1400°F.—16 hours—AC
	C.	2100°F.—½ hour—AC; 1400°F.—16 hours—AC
	D.	1975°F.—4 hours—AC; 1500°F.—24 hours—AC; 1400°F.—16 hours—AC

NOTE: Refer to appropriate heat treat code in Tensile & Yield Strength table.

*Waspaloy: Pratt & Whitney Aircraft Corp.; René 41, Astroloy and M-252: General Electric Company; Udimet 500: Metals Division, Kelsey-Hayes Company.

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permits designing to higher operating stresses . . . increased efficiency . . . greater component reliability for every gas turbine application

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WASPALOY

RENÉ 41

ASTROLOY

UDIMET 500

M-252

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- Rail and Highway Transport
- Power Generation
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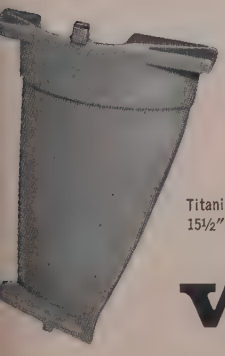
- Pipeline Boosting
- Auxiliary Service
- Automotive
- Marine Propulsion
- Stationary Power



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15½" length

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Titanium
24½" diameter
191 pounds

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GRAFTON MASSACHUSETTS LOS ANGELES CALIFORNIA PALO ALTO CALIFORNIA FORT WORTH TEXAS

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4

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Hardly Lethal, Shelvie's A Different Kind of Bookend

These aren't the storied bookends of the paperbacks or TV. Chances are they will never figure in a murder mystery. All they can do is hold a row of books—even a row of New York phone books—smartly in place.

They are called Shelvie, adjustable bookends created by New York designer George Nelson. A Shelvie is made of two anodized drawn aluminum tubes in either bronze or natural finish.

In addition to books, Shelvie holds records and folders upright on open shelves, and, placed horizontally, is a filing aid inside drawers and cabinets.

The secret of Shelvie lies in its coil spring, which permits an easily adjustable length between shelf or cabinet surface of from 9½ to 14 inches. Spring tension keeps Shelvie firmly in place, yet it can be moved and adjusted at will to meet changing storage and space requirements.

Shelvie, made and marketed by Structural Products Inc., of Charlotte, Mich., is the company's second product. The first was Omni, the versatile and flexible floor-to-ceiling "space-maker" system also designed by Nelson.

Dow Takes Option On Sheet Aluminum Corp.

The Dow Metal Products Co., Midland, Mich., has taken a six months' option to buy the land, buildings and equipment of Sheet Aluminum Corp., 701 Liberty St., Jackson, Mich.

Sheet Aluminum, a producer of rolled aluminum products, is a wholly owned subsidiary of Mueller Brass Co., Port Huron, Mich.

During the six-month period, products of Sheet Aluminum will be sold through Dow sales offices as well as by Sheet Aluminum's sales force.

Think what you can do with an open coil. Lee Wilson engineers, ever searching for better ways to anneal metal coils, scored an important breakthrough by devising a workable method for opening the coil laminations and for handling large opened coils of steel and non-ferrous metal to expose all coil surfaces to contact with high velocity heated gases. This has proved to be the most effective way to anneal yet discovered. But there's more—already Lee Wilson engineers are considering how to apply the open coil system for cleaning, coating, and gas alloying, in addition to annealing. Think what complete exposure of all of the coil surface means to your processing of coiled metal products. Then contact Lee Wilson engineers for complete details.

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Aluminum Arches Cover Eastern Water Reservoir

Water in the Pawtucket, R. I., Stump Hill reservoir is now cooler and cleaner thanks to the high heat reflectivity of a low cost aluminum roof covering the 20 million gallon storage tank. Installed at a cost of only $1.39 per square foot, the roof consists of 150,000 square feet of 0.032-inch alclad alloy 3004.

Charles A. Maguire & Associates, Providence, R. I., designed the roof so each aluminum arch (made of sheet 16 feet, 6 inches long) would span 15 feet. Total area to cover was 130,000 square feet. The sheet, supplied by Kaiser Aluminum, was fabricated and erected by the Elwin G. Smith Co., Pittsburgh.

The arching action not only adds strength (the roof can support 30 pounds per square foot) but more than doubles the unsupported span of this size aluminum sheet—which cut framing costs. The roof can support snow and ice. Men can walk on it (see picture) to make visual inspections. Edges of the arches rest on 8-inch flange beams; gutters between arches are grouted with cement.

Beams rest on concrete filled pedestals varying in height to give a proper pitch to the roof. Flat corrugated aluminum sheets were spanned vertically to close the ends of the 3-foot, 2-inch high arches. Also, sheets were spanned horizontally to cover the roof area between the ends of the arches and reservoir walls.

Only painting required was two coats of coal tar base paint for all steel surfaces and a heavy coat of bitumastic paint for aluminum in contact with steel or concrete. Cost of the roof and its supporting structure was $174,000.

Tempering Process Makes Al-Mg Alloys Stronger

A tempering process that is claimed to increase both the strength and reliability of the strongest of the aluminum-magnesium alloys has been developed by Aluminum Co. of America.

The process makes possible two new tempers: -H323 and -H343. Both assure maximum resistance to stress corrosion for sheet in alloys 5456 and 5083.

Alcoa now offers alloy 5083 sheet in both tempers with the same minimum guaranteed properties previously available in the -H32 and -H34 tempers. However, it now possesses superior resistance to stress corrosion. "In the new -H323 temper, alloy 5456 now exhibits a 4% increase in minimum tensile strength over any previously available," the company reported.

Minimum tensile properties for 5456 and 5083 sheet and plate in various tempers and gauges are indicated by the following chart.

		5083			5456		
Temper	Gauge (in.)	TS ksi	YS ksi	El %	TS ksi	YS ksi	El %
—0	.126-.750	48	18	16	42	19	16
	.751-2.000	38	16	16	42	19	16
—H321	.126-1.250	44	31	12	46	33	12
	1.251-2.000	44	31	12	44	31	12
—H113	.126-2.000	44	31	12			
—H323	.126-.249	45	34	8	48	36	8
—H343	.051-.125	50	39	6	53	41	6
	.126-.249	50	39	8	53	41	8
—H24	.051-.249	—	—	—	51	39	9

Aluminum Foils Becomes Consolidated Aluminum Corp.

Effective September 1 the name of Aluminum Foils Inc., Jackson, Tenn., will become Consolidated Aluminum Corp. The firm is an independent producer of aluminum foil, coiled sheet and super purity aluminum.

According to the company, "Growth and diversification have made it necessary to change our name to reflect our

broader scope of activities."

The firm has just completed a plant expansion program, tripling its capacity to produce super purity aluminum. Expansion and diversification in sheet production capacity is being contemplated.

Saw Blade Design Increases Efficiency

Following a two-year developmental period, Heinemann Saw Corp., Canton, Ohio, has introduced a low-cost, metal cutting circular blade designed for fast chip removal and free cutting.

"The saws are expertly hardened and ground to exact tolerance," the company reports.

Heinemann points out that one of the main causes of blade failure is improper lubrication. "With the Heinemann vacuum lubrication system, the four vacuum lubrication holes in the blade cause the mist created by the cutting to be drawn back into the operation.

"The holes attract the mist, deposit it near the hub and with the special radial micro-groove grind, the centrifugal force redistributes the lubricant along the side of the blade to the cutting points of the teeth where it is most needed, giving added cutting life between re-sharpenings, easier chip removal, smoother cutting action."

Heinemann says this design keeps the blade cooler in action and reduces cracking to a high degree.

4043 Aluminum Filler Wire Produced for Gas Welding

Aluminum welding wire 4043 is specifically designed as an all-purpose filler metal for both gas and electric fusion welding, says American Brazing Alloys Corp., Pelham, N. Y. The wire's principle alloying element is 5% silicon. It will join most aluminum alloys including 5052, 6053 and 6061 wrought alloys and cast aluminum alloys, according to American Brazing.

It produces a wide solidification range because it has a low melting point. This enables the metal to fill solidification voids without setting up stresses in the parent metal.

Aluminum Foils, Inc.

broadens its scope and changes its name to:

CONSOLIDATED ALUMINUM CORPORATION

Effective September 1, 1960

Aluminum Foils, Inc. has outgrown its name.

The Company was established as a producer of high-quality aluminum foil, and has become one of the leaders in this field.

Further diversifying and integrating, the Company has added its own aluminum casting and sheet production installations, and is now a major supplier of sheet aluminum for the growing market demand. A further expansion increasing capacity in coiled sheet products —both in regular mill and specialty classifications— will be announced soon.

The Company is the largest producer of super purity aluminum (99.99% to 99.999% pure) in America. A recent plant expansion has tripled our capacity for producing this remarkable metal—now available in the most complete range of forms including pig, pellets, re-roll stock, coiled sheet and foil.

Consolidated Aluminum Corporation will represent the same service-minded personnel and quality production that friends and customers have known as Aluminum Foils, Inc.

For data on our products write:

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Automatic Poultry House Design Benefits By Aluminum

This 10,000-bird poultry house is believed to be the first fully automated unit designed expressly for Southern poultrymen. It is built to take full advantage of warm-weather climate. Its aluminum features make it cost less per square foot of space, and also permit more birds per unit of space.

The house was built by the Fulton Co. of Shreveport, La., for the Triple L Egg Farm, Inc., Hamilton, Tex. In the house, one man is able to provide complete care for 10,000 laying hens, including egg handling. J. W. Fulton, Jr., president of the poultry equipment firm, said this type of automated facility complete with all equipment can be built for $2.50 to $2.95 per hen depending on the size of unit and the type of egg-handling machinery.

The Triple L building measures 38 feet by 240 feet. Eight automatic feed lines run the full length of the building, and 500 feet of watering space is provided. For storing of feed, there are two six-ton bulk bins and four 500-pound automatic feeder hoppers. Roll-out laying nests are located along each side of a central aisle, where eggs can be collected with a conveyor system.

The pole-type building has a Reynolds aluminum roof, and the front and rear ends also are of the lightweight corrosion-resistant metal. With its high reflectivity of the sun's radiant heat, the aluminum helps to keep the building cool during the summer months. In addition, Fulton "Fan-Foggers" with thermostat and humidistat automatically cool the entire house by evaporation. The sides of the building utilize polyethylene mounted on frames which can be raised to give open-air exposure during the summer, and lowered to give weather protection.

The Fulton Company is installing the buildings on a "turn-key" basis, delivered to the buyer ready-to-operate.

Iceless "Ice Box" Uses Foil, Corrugated Paper

The insulating qualities of corrugated paper are joined with the reflectivity of aluminum foil in the design of the Stonewall Iceless Ice Box, product of Stone Container Corp., Philadelphia 36, and Foil and Packaging Division of Alcoa Research Laboratories. They're designed for long use at a fraction of metal cooler costs.

Feather-light when empty, the iceless ice boxes measure 14¾ inches long, 10¾ inches high, and 7 inches in width. They are distributed folded flat. The user can quickly assemble the boxes. A tightly fitting lid serves as a convenient carrying handle.

Boxes can be attractively printed or otherwise inscribed by the offset process.

During tests of the new cooler, jugs of water, stored overnight in a refrigerator, were used to determine temperature rises. The refrigerator temperature was 48°F. at the moment the jugs were removed to be placed in the boxes. One jug went into a foil-laminated cooler, the other into an insulated steel cooler.

One Alcoa test revealed that the water in the foil-laminated cooler remained at a lower temperature for a longer period than the water stored in the conventional double-walled, insulated metal cooler. Heat for the test was supplied by a photoflood lamp, simulating noon-day sun.

Silk Screening Department Installed by Extruder

A silk screening department has been installed by General Extrusions Inc., 4040 Lake Park Rd., Youngstown, Ohio.

The firm reports no special difficulty in silk screening aluminum and has found that parts can be polished or anodized plain or in color prior to painting or silk screening.

GEI also has a department in which it can spray paint all aluminum shapes.

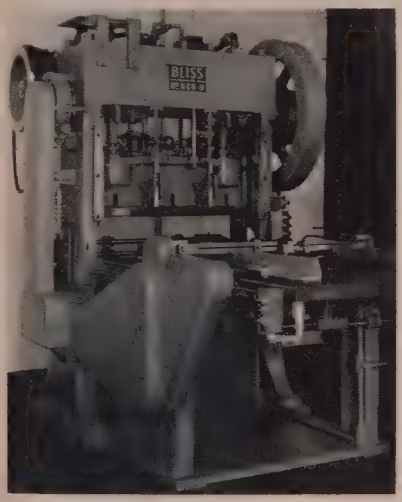
Compound Removes Oxide By Hand-Wiping or Dip

Oxide, scale and heat discoloration can be removed from aluminum by a simple method using OX-Off 536, developed by Chemclean Products Corp., 15-08 121st St., College Point, N. Y. The procedure may be used to clean aluminum before welding, to remove discoloration after welding, soldering, or heat treating, and to level off minor scratches and mars.

The manufacturer believes the technique is the only one by which oxide can be removed by hand-wiping or dip-tank operation with a ready-made solution, followed by a water rinse, all at room temperature.

"Surface resistance tests by a leading aluminum manufacturer show that the new method removes oxide completely," Chemclean Products said. "All that has to be done is saturate a clean rag with OX-Off 536 and wipe the surface of the aluminum; then rinse clear.

"For product evaluation, small parts may be dipped in the formula and rinsed, using as a dip tank the polyethylene 'Cubitainer' in which the cleaner is shipped."



Multiple Die Press Speeds Cap Production

A multiple die press for large quantity production of screw caps, tape cans, shoe polish cans and similar items is a new development of E. W. Bliss Co., Canton, Ohio.

An entire lithographed sheet of tin plate or aluminum can be fed to the multiple dies, producing 10 or more caps per stroke. Operating speeds range from 100 to 125 strokes per minute.

Built in two sizes, the smaller model, 660D, can produce eight 48 or 53 mm caps per stroke. The larger model, 6100B, produces ten 70 mm caps per stroke or a correspondingly lower number of larger size caps.

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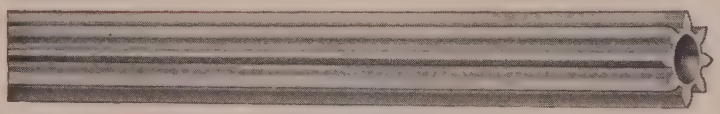

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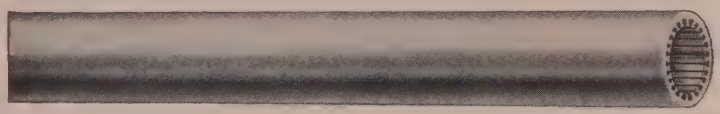

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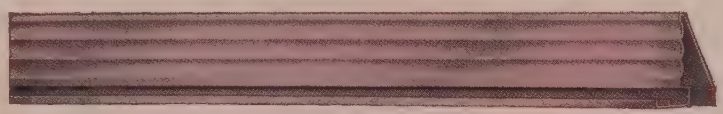

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Aluminum Scrap Recovery Rises Over '58 Total

Some 360,000 tons of aluminum scrap of all types were recovered from domestic operations in 1959. This was about 70,000 tons more than the 1958 total, according to a Bureau of Mines report. In 1959 the recovery from new scrap represented 78% of the total aluminum recovered. Recovery of aluminum alloys (aluminum, plus alloying constituents recovered) was 387,000 tons in 1959, only 1000 tons below the record high recovery of 1957.

The value of the 360,000 tons of aluminum (excluding alloying ingredients) recovered, computed from the average value of primary aluminum pig of 24.46 cents per pound, was $176 million.

Aluminum-alloy ingot production totaled 341,000 tons, 41% more than was reported in 1958. Data on remelt ingots exclude alloys produced from purchased scrap by the primary producers, the Bureau of Mines said.

Shipments of many casting alloys increased sharply in 1959. Shipments of AXS 679 were up 47% to 129,000 tons; the miscellaneous category nearly doubled to 28,000 tons. Increases in shipments of pure aluminum (97%), alloy No. 319 and variations, and deoxidizing alloys ranged from 7800 to 8800 tons.

Consumption of aluminum scrap by all groups increased 27% in '59, compared with the previous year. Of the total of 476,000 tons of scrap consumed, secondary smelters used 384,500 tons or 81%, up from 73% in 1958. Consumption of scrap by primary producers and fabricators accounted for only 13% of the total in comparison with 21% in 1958.

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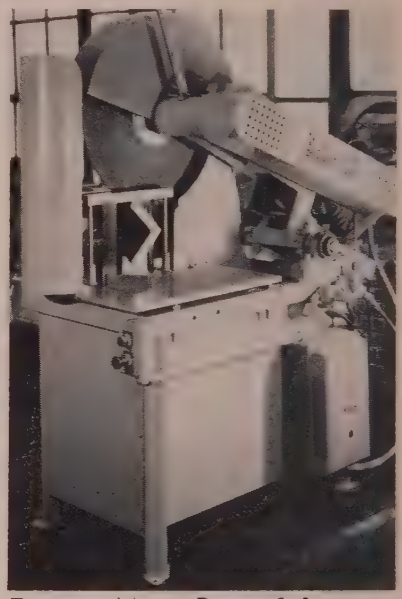


Faster, More Powerful Cutting Machines Developed

Operating improvements and greater power are new features of the line of abrasive cutting machines made by Wallace Supplies Mfg. Co., Chicago.

The "cut-machining" unit pictured is made in four sizes: cutting wheel diameters of 16, 18, 20 and 26 inches; horsepowers of 7½, 10, 15 and 20 respectively.

With faster cutting of pipe, tube, I-beams, angles and bars, the cuts themselves are said to have finishes measuring 30 to 70 micro-inch on both cut ends. Examples of cutting speed offered by Wallace include a 6x6x1-inch angle iron, cut in 28 seconds with a finish of about 65 micro-inch; an I-beam 8⅜ x 8¾ inches x 69 pounds, cut in about a minute with a finish of about 60 micro-inch; a 4x2½x¼-inch I-beam, cut in about 10 seconds.

One Operation Impregnates, Coats Magnesium Castings

A process that combines impregnation and paint-base coating of magnesium alloy castings in a single operation has been developed by Dow Metal Products Co., Midland, Mich.

Dow says the process is a modification of the standard Dow 17 anodize treatment, which provides a paint base but

does not seal all of the porous areas of castings. The modification allows a dwell or current "dribble" of 20 to 30 minutes, constant voltage, at the end of the normal anodizing period. During the dwell, anodizing continues primarily in the pores of the casting, sealing even minute pores effectively, claims Dow.

The resulting seal is said to withstand air or water pressure of at least 40 pounds and heating to at least 700°F. Other claims: It will withstand high humidity; exterior weathering; is stable in hot engine oil, gasoline and kerosene.

The complete process is as follows: Cleaned and bake-dried castings are placed in a standard Dow 17 electrolyte and anodized using a-c or d-c. Final voltage varies from 60 to 95, depending on the coating thickness desired.

At the end-voltage requirement for formation of the paint-base coating, the voltage is held constant for an additional 20 to 30 minutes. During this period the current flow gradually recedes to a low current level. The procedure for applying a thin coating, which uses a lower voltage than for full coating, will provide sealing except in cases of extreme porosity.

Coast Tubing Show Was Big Success

A unique trade show devoted to tubing of all kinds focused attention on the show's sponsor, Kilsby-Tubesupply, big Los Angeles tubing distributor. Show-goers saw the latest developments in manufacture, fabrication and assembly of tubular products including aluminum, steel, alloy and exotic metals. More than 2000 industry representatives attended; 61 exhibitors comprised a "Blue Book" of metalworking firms, demonstrating their products and new techniques to design men, engineers, and production personnel.

R. Perry Kilsby, president of the sponsoring firm, said the show was designed to meet the growing needs for an exchange of information on tubing between users and producers.

Men-on-the-move

Edwin G. Drewry has been named manager of the Phoenix (Ariz.) Extrusion Plant of Reynolds Metals Co. At the same time **James M. Hairston** became plant superintendent. He replaced acting superintendent **R. V. Bobb,** who returned to Richmond to resume his duties as assistant general manager of the extrusion division.

New vice president of Howe Sound Co., New York, is **Albert H. Charlton.** He will head up the company's Rolling Mill Div'n. Charlton was president of Quaker State Metals Co., Lancaster, Pa., a Howe division.

Richard L. Shinsky has been appointed to the newly created post of manager of product development of Aluminum Extrusions Inc., Charlotte, Mich.

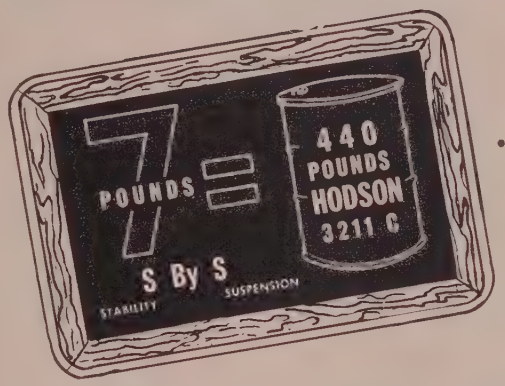
New technical director of Rea Magnet Wire Co., Inc., an Alcoa division, is **E. Mark Wolf.** He will head the firm's expanded research and development activities.

Farrel-Birmingham Co., Inc., Watson-Stillman Press Div'n, Rochester, N. Y., has appointed **R. John Hess** manager of metalworking equipment.

Dow Metal Products Co. has assigned **Robert E. Bockrath** to a new group responsible for developing aluminum and magnesium applications in the railroad industry. He will be based at company headquarters in Midland, Mich.

Richard E. Cole is the new plant manager at Reynolds Metals Co.'s St. Lawrence aluminum reduction facility at Massena, N. Y. He formerly headed the new industrial engineering department at the firm's Listerhill (Sheffield), Ala., reduction plant.

Frederick H. Wilson has joined Wells Aluminum Corp., North Liberty, Ind., as general sales manager. He will concentrate on expansion of custom extrusion sales throughout the midwest.



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Looking Ahead

More primary aluminum producers in the wind? While raising big money is the real drawback (due to slow pay-back), there's plenty of action in the bullpen. Rumor has it that five large aluminum fabricators have already pooled several hundred thousand dollars to investigate various reduction processes. Other smaller groups are on the prowl for the big money needed to erect a 30-50,000 ton reduction plant over a coal mine. As one big fabricator says: "We see the signs in big bold letters . . . either get into the act or watch them take away our business." Even the state of Kentucky is promoting how little it costs to produce aluminum in that state. Look for at least two new primary producers to get underway in 1961.

Imports have all but wrecked the U. S. sewing machine and toy industries. Now fastener manufacturers claim imports have taken away 70% of their business. Glass producers are hollering that they've lost 25% of their sheet glass business to foreign firms since last year; that imports have risen over 30% of domestic production in the past decade, while glass exports have declined 66%. Foreign insulated wire and cable is coming into the U. S. at a rate 10 times over 1958, and 400% over last year — at about 15% below U. S. prices. On the other hand, aluminum men have been talking with Commerce Department about methods to increase exports of aluminum — which are now at an all-time high. It's a pretty involved subject; one which we hope to detail next month.

Ford is thinking of switching its exterior trim parts from aluminum to stainless or plated zinc next year. Reason: Many anodized parts are corroding. Anodizing is not enough protection, says one auto engineer. Jobbing anodizers might agree, but they'll explain that nobody can apply even a half-decent job for 4¢ — on a headlight frame, for example — when it should cost 10 to 14¢. All they're getting is a flash anodize — about 1½ ten-thousands. They need 4 ten-thousands, says one anodizer who has refused to bid on the work. Not too long ago, nickel-plated bumpers rusted through in a few months. The excuse then: A nickel shortage. But there's no excuse for poorly anodized aluminum parts. The trouble lies in sub-standard auto specifications — and they'd better be corrected before it's too late. Look for our technical article on this subject next month.

Lots of opportunity in porcelain enameling aluminum. A few years ago when DuPont and Ferro gave it the big push, a new group of enamelers came into being. But too many were going after too small a potential. Several dropped out. Ferro (Cleveland) kept after the business, which has grown over 20% a year in the past three years. It's beginning to pay off. This year, Aloxon Corp., Madison Heights, Mich., got into the business as a result of doing fabricating work for manufacturers who also wanted the aluminum parts enameled. Aloxon sees a big potential — particularly in the architectural field. We estimate that 20 million square feet of aluminum will be procelain enameled this year; perhaps 28 million next year. Some see a 40 million potential by 1962.

Inventories are the key to the inevitable business upturn (currently touted as a sure thing early in 1961 by many magazines and manufacturers). Customer inventories have rarely been lower, they say, and any business spurt will result in rush orders and a resumption of the boom. They also argue that the copper industry is holding the 33¢ price — because of troubles in the Congo, possible labor strife in Chile, and an upturn in autumn bookings. In steel, they say, the upturn will start soon as next year's cars start rolling off the line. For a change, auto men are mum on what they'll sell next year. They know they'll sell still more compacts and fewer standards, which means less steel consumption and smaller profits for car makers. It's rubbish to think that inventories will determine business activity this fall, winter, or next spring. With every product in over-abundant supply, the consumer can wait. He's still buying when he sees a bargain or an improved product — and that's the *key*. Manufacturers who are coming up with new ideas and are promotion-minded should enjoy good business next year. The me-too, fast-buck and no-promotion outfits will starve to death.

Home buyers can wait for bargains — and they're doing it, say builders. Easier credit and lower interest rates are not stimulating enough demand. In many areas the $10,000 to $14,000 market has dried up. But there's more action in the middle and high-priced home bracket, and older, bigger houses are moving better than in years. Could mean that the buyer is tired of cheap look-alike boxes that are going up on any patch of unused land in the outskirts. On the other hand, plenty of big luxury-type apartments are going up and private housing developments of the custom-built variety (see "News"). This type of building is up 33% over last year; could well be the building industries' bell-ringer next year. Another bright spot is the vacation house market. Three years ago only about 40,000 of these were recorded. Last year the number jumped to 75,000, and the plywood boys look for the demand to top 200,000 annually by 1962. With longer vacations, shorter work weeks, the vacation house trend can develop into a prefab do-it-yourself market. New design ideas in aluminum will take it away from the plywood outfits.

— The Editors

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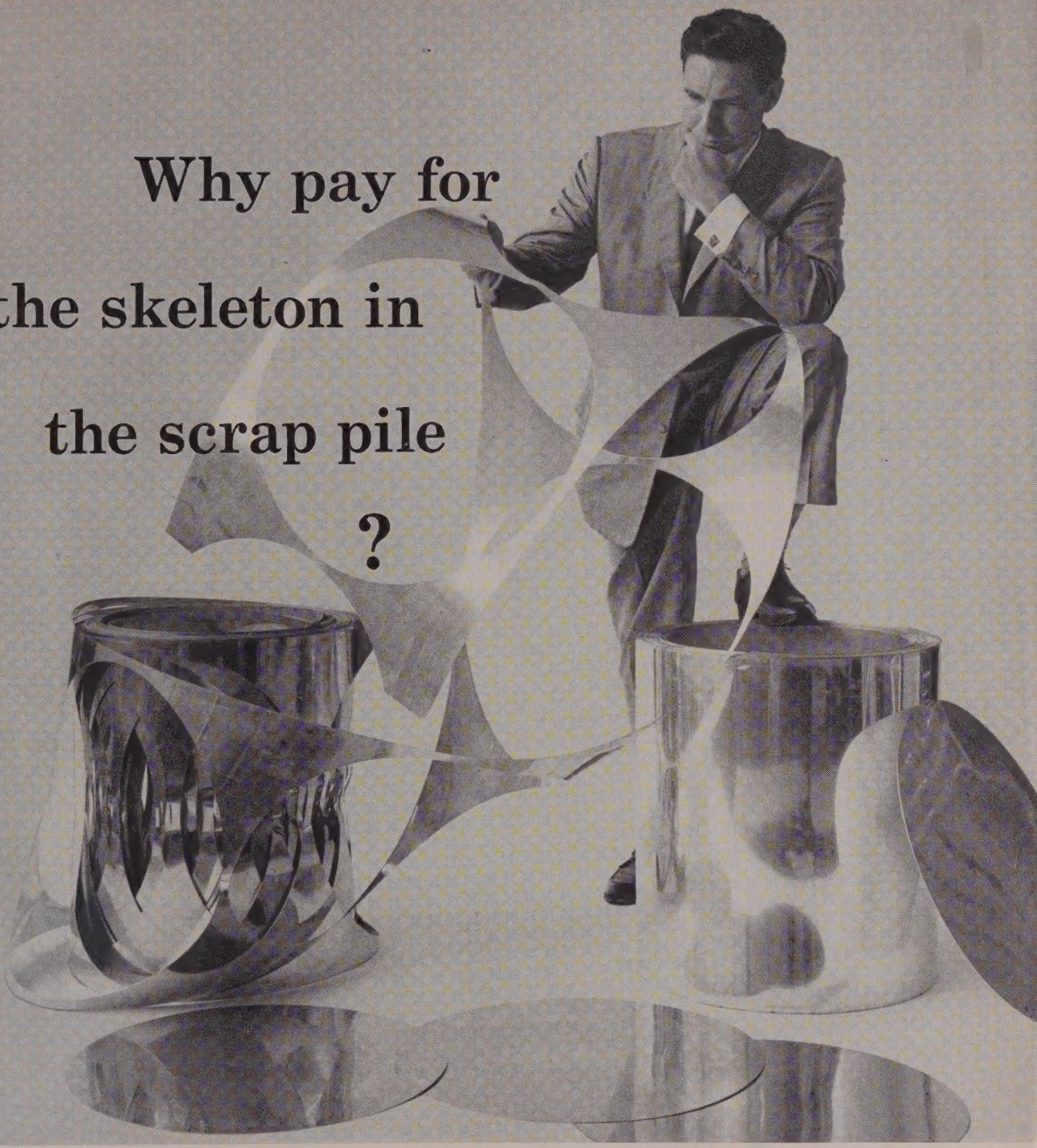

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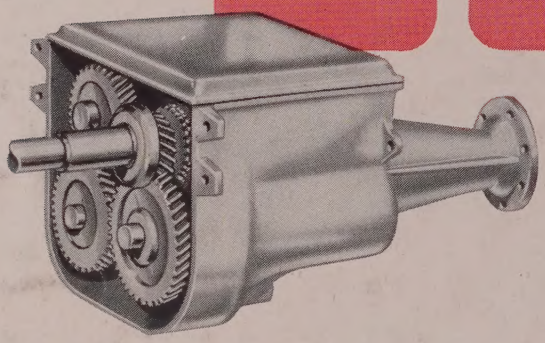

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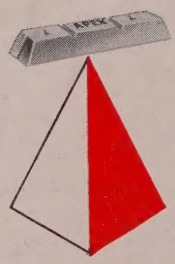

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